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February 28, 1989

Energy Research Abstracts

Abstracts 5731-7192

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UNITED STATES DEPARTMENT OF ENERGY

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ENERGY RESEARCH ABSTRACTS

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 13-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

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Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

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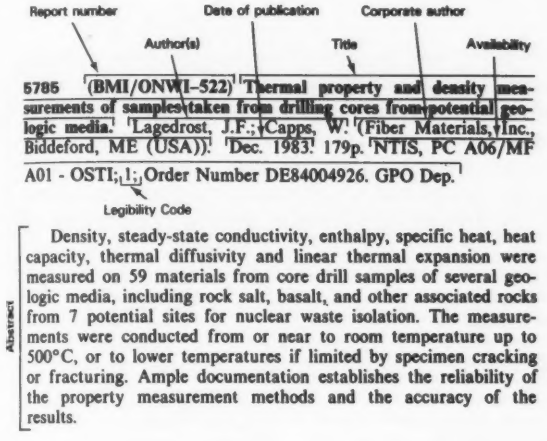
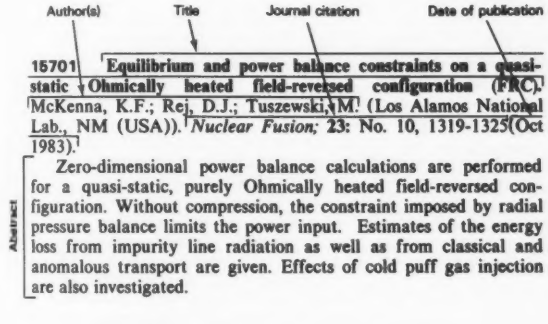
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01 - OSTI; 1; Order Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

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REVERSED-FIELD PINCH
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Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9: 15701 (J;AT)

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DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. OSTI Order Number DE84004926, Distribution Category MN-70

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Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 289 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

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5731 **(DOE/PC/79919—5) Flotation and flocculation chemistry of coal and oxidized coals: Annual technical progress report, September 15, 1987 to September 15, 1988.** Somasundaran, P. (Columbia Univ., New York (USA)). 1988. Contract FG22-87PC79919. 59p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003313/JAW.

This project is designed to develop an understanding of the fundamentals involved in flotation and flocculation chemistry of coal, and of coal in various states of oxidation. Proximate and ultimate analysis of Bruceton mines seam pgh coal revealed it to be of high volatile bituminous quality. The basic nature of the heterogeneity that exists on the coal surface, and its role in controlling interfacial phenomena is studied by monitoring the changes in the surface site distribution as determined by centrifugal immersion and film flotation. Adsorption isotherms of nonionic PAM and cationic PAM of 10% cationicity, are of the high affinity type typical of polymer adsorption. Site distribution curves constructed from film flotation of PAM treated coal suggest the cationic PAM of 34% cationicity and nonionic PAM to form a more compact adsorbed layer than cationic PAM of 10% cationicity or anionic PAM. Low temperature oxidation of coal at 70{degree}C in air results in marked changes in the surface site distribution. Results obtained show the important role configuration of the adsorbed species can play in determining the behaviour of coal. 26 refs., 13 figs., 1 tab.

5732 **(DOE/PC/80514—T1) Chemistry and reactivity of micronized coals: Final technical report.** Lloyd, W.G.; Riley, J.T.; Kuehn, K.W.; Kuehn, D.W. (Western Kentucky Univ., Bowling Green (USA)). 15 Feb 1988. Contract FG22-85PC80514. 231p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE88006093/JAW.

Mid-rank coals are rapidly comminuted by a stirred-ball slurry attritor mill. The mean particle diameter (average of eight coals) falls from 178 to 20 microns in four minutes. In the same period the average fraction greater than 325 mesh (45 microns) falls from 67% to 3%. Energy requirements are less than 30 kwh/US ton. For individual coals the ease of comminution and the energy requirements for slurry attrition correlate weakly with Hardgrove Grindability Index. An extended HGI is shown to have better predictive power. Extended attritor milling (for periods of 15 minutes to several hours) results in moderate incremental size reduction, but coal density is increased and bitumen is expressed, indicating the substantial collapse of partially filled macroporous structures. This leads to anomalous effects with regard to visual appearance, ease of drying, and apparent viscosities of slurries. Micropore structure as evidenced by B-E-T measurements is increased by extended milling. Coal which has been "micronized" has been stored for 12 months under various conditions. At ambient temperature and vented to air, micronized coal is oxidized more extensively than {minus}60 mesh coal. Micronized coal stored at subambient temperature, and/or stored in sealed containers with 0.1% hydroquinone present, undergoes relatively little oxidative degradation. Results of several sets of experiments exploring physical and chemical beneficiation are reported. Combinations of float/sink and light attritor milling permit the separation of more than 90% of the original mineral matter. 47 refs., 56 figs., 48 tabs.

5733 **(DOE/PC/80530—T7) Carbon dioxide for fine coal flotation: Final report, September 1985--December 1987.** Miller, J.D. (Utah Univ., Salt Lake City (USA). Dept. of Metallurgy and Metallurgical Engineering). Dec 1987. Contract FG22-85PC80530. 75p. NTIS, PC A04/MF A01 - OSTI. Order Number DE88005659/JAW.

A detailed research effort on the fundamentals of coal flotation by carbon dioxide was initiated. Research has been carried out on different aspects of the problem including hydrophobic characterization, bench-scale flotation, carbon dioxide adsorption, electrokinetic behavior, and FTIR spectroscopy for coals of different rank. Coal hydrophobicity as defined by contact angle and bubble attachment time measurements also can be characterized by diffuse reflectance FTIR spectroscopic criterion---the hydrophilicity index---which contrasts the relative abundance of surface hydrophilic groups with the relative abundance of surface hydrophobic groups. This index can be used to predict or estimate the flotation behavior of coals of different rank. Rank-dependence of coal hydrophobicity established by macroscopic characterization and FTIR spectroscopy can be verified by XPS for dry coals and in-situ ATR-FTIR spectroscopy for wet coals. Contact-angle and bubble attachment-time measurements as well as FTIR spectroscopy reveal the enhanced hydrophobicity of CO{sub 2}-treated coal and explain the improved flotation response with carbon dioxide flotation. BET measurements, differential scanning calorimetry, and FTIR spectroscopy confirmed that CO{sub 2} is specifically adsorbed at the coal surface. In-situ FTIR studies suggest that carbon dioxide adsorbed on both the internal and external surface of coal is polarized. Partial solvation of the first layer of adsorbed CO{sub 2} results in a CO{sub 2}-covered coal surface, which appears to convert some of the hydrophilic sites into hydrophobic sites. The high specific affinity of coal for CO{sub 2} results in the displacement of pore water and leads to nanobubble formation at the coal surface during flotation. Specific adsorption and the nanobubble formation contribute to the enhanced flotation response. 67 refs., 33 figs., 16 tabs.

5734 **(IS—4946) Sonic enhancement of physical and chemical cleaning of coal: Fossil energy quarterly report, 1 October 1987--31 December 1987.** Buttermore, W.H.; Slomka, B.J.; Seward, K.J. (Ames Lab., IA (USA)). Feb 1988. Contract W-7405-ENG-82. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003754/JAW.

Research efforts during the first quarter of fiscal year 1988 were concentrated on performing laboratory tests to determine the effects of lower frequencies on the sonic enhancement of physical coal cleaning processes. Using special low-frequency transducers supplied by the Raytheon Company, 136 sonication tests were performed. The frequency range from 2.0 to 10.0 kHz was examined for both near-field and directed-wave techniques. Also, the effects of exposure to intense cavitation were examined for gravity-controlled and surface-controlled coal cleaning methods. Preliminary results indicate that there is a beneficial effect of certain frequencies on the quantity of coal recovered from gravity-controlled and microbubble coal cleaning processes. The effect of frequency on coal quality will be determined when ash and sulfur analyses have been completed. 6 figs., 2 tabs.

5735 **(IS—4947) Regeneration of alkali in caustic desulfurization systems: Quarterly report, October 1, 1987--December 31, 1987.** Markuszewski, R.; Norton, G.A.; Chriswell, C.D.; Shah, N.D. (Ames Lab., IA (USA)). Jun 1988. Contract W-7405-ENG-82. 28p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003753/JAW.

During hot countercurrent washing of Pittsburgh No. 8 coal samples which had been subjected to molten caustic leaching

(MCL) with a NaOH/KOH mixture, carbonates accumulated in intermediate washing stages, resulting in decreased filtration rates, increased fluid retention by the filter cakes, and the consumption of excessive amounts of H_2SO_4 in the acid wash. The concentration of the final caustic solutions approached 50%. Thus, the countercurrent washing procedure will probably require modifications to alleviate these problems. Jarosite/natrojarosite is probably the only double salt which will form using the concentrations and mole ratios of compounds anticipated to be present in the spent acid under typical MCL conditions. Also, the spent acid probably cannot be simply heated to precipitate jarosite; ferric salts may need to be added to increase the iron concentration in the solution to suppress the formation of contaminant iron compounds, particularly if only NaOH is used for caustic leaching of coal. Problems in removing Na by double salt precipitation are compounded as a result of hydronium ion substitution for the alkali metal in the jarosite structure. If acid neutralization is used, it appears that precipitating jarosite-type compounds can effectively remove Na and Fe from the spent acid, even at temperatures of 80{degree}C. 11 refs., 7 figs., 9 tabs.

5736 **(IS—4951) Mechanisms for selective coalescence of coals: Fossil Energy quarterly report, 1 October 1987--31 December 1987.** Wheelock, T.D.; Markuszewski, R.; Fan, C.W.; Venkatadri, R.; Labuschagne, B.C.J.; Hu, Y.C.; Tyson, D. (Ames Lab., IA (USA)). Dec 1987. Contract W-7405-ENG-82. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003749/JAW.

The overall objective is to determine the basic mechanisms which underlie a number of selective coalescence or oil agglomeration processes that have been proposed for beneficiating fine-size coal. Recent work has shown that the oil agglomeration recovery of less hydrophobic Illinois No. 6 coal is reduced by an increase on ionic strength of the suspending medium. Also the oil agglomeration recovery of iron pyrite is reduced by an increase in ionic strength and the reduction is affected by the cations present. Thus, pyrite recovery is affected increasingly by Na^+, Ca^{++}, and Mg^{++} ions in that order. To study the effect of mild surface oxidation on the oil agglomeration of Pittsburgh seam coal, a freshly ground sample of the coal was exposed to air at room temperature for one week. When agglomerated with heptane, the recovery from neutral or acidic suspensions was similar to that of untreated coal, but the recovery from basic suspensions was lower than that of untreated coal. The total sulfur content of the agglomerated product was significantly lower for the treated coal. The use of magnesium salts as selective depressants for pyrite was investigated and found to be very effective in the separation of a synthetic mixture of hydrophobic Upper Freeport coal and pyrite by oil agglomeration. However, when a magnesium salt was applied to the separation of a synthetic mixture of the less hydrophobic Illinois No. 6 coal and pyrite, both coal and pyrite were depressed. 3 refs., 12 figs., 4 tabs.

5737 **(IS—4959) Sonic enhancement of physical and chemical cleaning of coal: Fossil energy quarterly report, January 1, 1988--March 31, 1988.** Buttermore, W.H.; Slomka, B.J.; Dawson, M.R. (Ames Lab., IA (USA)). May 1988. Contract W-7405-ENG-82. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003744/JAW.

Research efforts during this quarter involved the completion of laboratory tests to determine the effects of lower frequencies on the sonic enhancement of physical coal cleaning processes. Ash and sulfur analyses were completed for 136 coal samples sonicated by using low-frequency transducers supplied by the Raytheon Company. In these tests, the frequency range from 2.0 to 10.0 kHz was examined for both near-field and directed-wave techniques. Also, the effects of exposure to intense cavitation were examined for improvement of gravity-controlled and surface-controlled coal cleaning methods. The most beneficial results were obtained for gravity-controlled cleaning of 8 by 100 mesh Illinois No. 6 coal by exposure to pulsed, non-cavitating, near-field sonic energy at a frequency of 9.0 kHz. Comparing results of identical sink-float tests of unsonicated and sonicated coal, float recovery was increased by sonication from 67.9% to 71.2%, while the ash content of the float was reduced from 10.0% to 9.0%. As in previous tests with this Illinois seam coal, no significant effect on sulfur content was observed as a result of sonication. 3 refs., 18 figs., 6 tabs.

5738 **(IS—4961) Regeneration of alkali in caustic desulfurization systems: Quarterly report, 1 January 1988--31 March 1988.** Markuszewski, R.; Norton, G.A.; Chriswell, C.D. (Ames Lab., IA (USA)). May 1988. Contract W-7405-ENG-82. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003757/JAW.

Additional studies were performed on model spent acid solutions to determine the effects of time, temperature, and pH on yields of natrojarosite ($NaFe_3(SO_4)_2(OH)_6$). The desired pH values (in the range of 1.1 to 2.3) were maintained during the tests by adding either H_2SO_4 or $CaCO_3$. It was shown that precipitation of jarosite-type compounds can effectively remove Fe and SO_4/sup =/ impurities from model solutions of spent acid. Although the analytical data for Na require further interpretation, it appears that substantial amounts of Na can also be precipitated as natrojarosite. The optimum pH for precipitating natrojarosite appears to be about 1.5. Using Fe_2O_3 as a source of ferric iron does not appear to be a satisfactory alternative to using $Fe_2(SO_4)_3$. If a NaOH/KOH mixture is used in the MCL process, the apparent preferential precipitation of Na_2CO_3 rather than K_2CO_3 could improve process economics slightly, but it may complicate precipitation of Na as natrojarosite from spent acid streams since the Na jarosite species does not form as readily as the K jarosite. 6 refs., 6 figs., 5 tabs.

5739 **(IS—4965) Mechanisms for selective coalescence of coals: Fossil energy quarterly report, January 1--March 31, 1988.** Wheelock, T.D.; Markuszewski, R.; Fan, C.W.; Venkatadri, R.; Labuschagne, B.C.J.; Hu, Y.C.; Tyson, D. (Ames Lab., IA (USA)). May 1988. Contract W-7405-ENG-82. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003761/JAW.

Coal, pyrite, and graphite particles were agglomerated individually with heptane to obtain a more complete picture of the interacting effects of several parameters on particle recovery. The parameters included particle hydrophobicity, heptane dosage, and the ionic strength of the suspending medium. The relative hydrophobicity of the different solids was determined by measuring the induction time, or time required for attachment of one or more particles to a small gas bubble when brought into contact with it. Increasing the ionic strength of the suspending medium increased both the apparent hydrophobicity and recovery of highly hydrophobic coals and graphite, whereas it decreased both the hydrophobicity and recovery of weakly hydrophobic materials. The hydrophobicity of various materials was also evaluated by measuring the heat of immersion of the materials in water and sodium chloride solutions with a microcalorimeter. Results seemed to correlate with both oil agglomeration recovery and induction time measurements. The application of various pyrite depressants such as $Ca(OH)_2$ or the salts of magnesium, copper, and aluminum to the cleaning of Upper Freeport coal by oil agglomeration showed that both the sulfur and ash contents of the coal were reduced significantly by the depressants. Results indicated that the successful application of such depressants will depend on several critical factors including the type of coal, depressant concentration, pH, oil dosage, and coal particle size. 4 refs., 16 figs., 3 tabs.

5740 **(IS—4975) Mechanisms for selective coalescence of coals: Quarterly report, April 1, 1988--June 30, 1988.** Wheelock, T.D.; Markuszewski, R.; Fan, C.-W.; Hu, Y-C; Tyson, D. (Ames Lab., IA (USA)). Aug 1988. Contract W-7405-ENG-82. 21p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003767/JAW.

Oxidized Upper Freeport coal, Illinois No. 6 coal, and mineral pyrite were suspended individually in water or salt solutions and agglomerated with heptane to determine the effects of salt concentration, pH, time of oxidation, and other parameters on particle recovery. The relative hydrophobicity of the different solids was determined by measuring the induction time. Oxidizing Upper Freeport coal in air at 150{degree}C for a number of hours reduced the hydrophobicity of the coal. Oxidation changed the response of the coal to agglomeration in a salt solution. The recovery of oxidized coal was reduced by an increase in ionic strength. Oxidized Upper Freeport coal behaved much like untreated Illinois No. 6 coal. When these coals or mineral pyrite were treated with sodium oleate, their hydrophobicity was greatly increased, and their recov-

ery by agglomeration with heptane was enhanced markedly. Agglomeration recovery was increased by an increase in ionic strength of the suspending medium. The effect of sodium oleate was most pronounced at about pH 5. When Upper Freeport coal or mineral pyrite was treated with the sodium salt of humic acid, humic acid was adsorbed by these materials which affected the zeta potential, induction time, and agglomeration recovery of the particles. The hydrophobicity and the recovery of the materials were reduced. With an optimum concentration of humic acid, the separation of a mixture of Upper Freeport coal and mineral pyrite by selective agglomeration was improved slightly. The heat of immersion of various carbonaceous materials in water was found to correlate closely with the measured induction time. 1 ref., 18 figs., 1 tab.

5741 **(IS-M—612) Oil agglomeration of oxidized coal.** Sadowski, Z.; Venkatadri, R.; Druding, J.M.; Markuszews'i, R.; Wheelock, T.D. (Ames Lab., IA (USA)). [1986]. Contract W-7405-ENG-82. 13p. (CONF-8609104—4). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003738/JAW.

From 6. international workshop on coal, liquid, and alternate fuels technology; Halifax, Canada (29 Sep 1986).

The effect of surface oxidation on the oil agglomeration characteristics of coal has not been well documented, although it is known that lower rank, hydrophilic coals are more difficult to agglomerate than higher rank, hydrophobic coals. In order to contribute to a better understanding of the effect of surface oxidation, the present investigation was undertaken. Upper Freeport bituminous coal from Pennsylvania was selected for the study because it is normally hydrophobic and readily agglomerated. A surface oxidation treatment was applied to this coal to see how it would affect the agglomeration characteristics of the material. In determining these characteristics, samples of oxidized and unoxidized coal fines were suspended in water and agglomerated with pure aliphatic hydrocarbons. Both the pH of the suspension and amount of added oil were varied, and in some cases various surfactants were added to the suspension. The electrokinetic properties of the coal particles and oil droplets were also determined to gain further insight. 12 refs., 10 figs.

5742 **(NP—9770116) Vacuum dewatering and -drying of finest hard coal particles. Final report.** Kroemer, E.A.; Simonis, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Nov 1987. 97p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770116/JAW.

Based on a German patent (DE 2191418 C2) a vacuum-condensation dryer was developed in laboratory-scale. The target was the drying of hard coal finest particles in a process which is characterized bei minimizing the use of energy and working without air pollution. The results of the tests, which are received by variation of various parameters could be mathematically described and physically explained. The results correlates with tests carried out in pilot scale. The energy input by using microwaves was also subject of the successfully investigation. (orig.) With 63 refs., 12 tabs., 33 figs.

0104 Processing

REFER ALSO TO CITATION(S) 5765, 5780, 5780, 5787, 5789, 6088

5743 **(DOE/CE/15227—5) Evaluation of the KIDC [Kress Indirect Dry Cooling] system for coke oven pushing and quench tower emission control.** Vajda, S. (S and E Consultants, Inc., Pittsburgh, PA (USA)). 23 Sep 1988. Contract FG01-85CE15227. 47p. NTIS, PC A03 - OSTI. Order Number DE89000002/JAW.

The KIDC system, as observed at Granite City Steel on June 21, 1988, eliminates both pushing and quenching emissions. The coke is pushed into a container that is slightly wider and longer than the oven. The container is sealed at the oven door jamb, a guillotine door on the container is opened at the oven for the push and is closed and sealed after the push. A slightly negative pressure is maintained in the container during the push to prevent any pollutants from exiting into the oven or escaping to the atmosphere. The pushing force is only slightly higher than the normal push. No volatile gas mixtures are in the container box since oxygen is effectively absent. Coke yield is improved. Coke quality is improved similarly to existing dry quench systems. Since the system is environmentally sealed, some coking can take place in the container, ovens could be pushed slightly earlier, improving the production of the battery. The production of the blast furnace could be expected to improve, when the improved quality KIDC coke is used. 13 refs.

5744 **(DOE/FC/10620—2622) Pulsating gasification low-rank coals: Final report.** Powell, E.A.; Zinn, B.T.; Narayanaswami, L.L.; Daniel, B.R. (Georgia Inst. of Tech., Atlanta (USA). School of Aerospace Engineering). Apr 1988. Contract AC21-84FC10620. 159p. NTIS, PC A08/MF A01 - OSTI. Order Number DE88010283/JAW.

A one-dimensional, unsteady coal gasification model was used to develop a computer program to describe the pulsating operation of entrained flow type reactors for the gasification of low rank coals. In studies conducted with this model, the devolatilization process was assumed to be completed in a large reservoir ahead of the gasifier inlet, and gas phase reactions were neglected. The char particles were assumed to undergo reactions with oxygen, steam, and carbon dioxide in the gasifier under the combined influence of diffusion and chemical kinetics. Pulsating solutions were obtained by first obtaining the steady state solution and then introducing a finite amplitude fundamental mode acoustic pressure perturbation. The subsequent behavior of the oscillations was obtained by integrating the conservation equations using the Lax-Wendroff predictor-corrector technique. In this manner, the computer program was used to investigate the effect of gasifier geometry and such operating parameters as the feed gas composition and inlet gas and particle temperatures upon the performance of steam-oxygen type pulsating gasifiers. In a parallel study, an experimental pulsating coal gasifier was used to investigate the effect of pulsations on the composition of the product gas. The presence of pulsations had little effect on the concentrations of the major constitutents in the product gas (carbon monoxide and carbon dioxide). The presence of pulsations did, however, result in significant reduction in the sulfur dioxide emissions of the gasifier. 62 figs., 10 tabs.

5745 **(DOE/MC/21313—2593) Reaction kinetics and physical mechanisms of ash agglomeration: Final report.** Carty, R.H.; Mason, D.M.; Babu, S.P. (Institute of Gas Technology, Chicago, IL (USA)). May 1988. Contract AC21-84MC21313. 197p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number TI88010266/JAW.

Several significant insights into the mechanisms and chemistry of the formation of ash agglomerates have been made: (1) The reaction of iron-and-calcium-containing components of coal ash with the siliceous components is critical for the formation of relatively low-melting aluminosilicates that makes it possible to form ash agglomerates in a fluidized-bed coal gasifier. (2) The association of the calcium and/or iron components with the siliceous components in single particles differs greatly from one coal to another. (3) One result of the variation in the association of the ash components is that the availability of low-melting agglomerative product also varies from coal to coal. Another result is that it is likely that the ease of agglomeration of the whole of the ash by collision with low-melting material will also vary. (4) The viscosity-temperature relationship of the ash reaction products is their most important property affecting the rate of agglomeration among reaction products and of the reaction products with unreacted ash. (5) In reactivity tests, approximately 2200{degree}F was found to be the minimum temperature for oxidation of ferrous sulfide and the onset of reaction of the oxidation product with siliceous minerals within a period of a few seconds. The latter reaction, which is critical to the formation of the iron aluminosilicate matrix of the ash agglomerates, can occur at temperatures as low as 1800{degree}F but at a much slower rate. The high temperature of the jet region, as well as its oxidizing atmosphere, is necessary for formation of the low-melting agglomerative matrix material. (6) Phase diagrams showing the effect of gasifier atmosphere on equilibrium among ferrous sulfide and its products have been prepared to cover part of the range of conditions that can be encountered in the gasifier. 47 refs., 60 figs., 42 tabs.

5746 **(DOE/MC/23275—2589) Study of ammonia removal in coal gasification processes using integrated systems approach: Final report.** Unnasch, S.; Chang, R.; Mason, H. (Acurex Corp., Mountain View, CA (USA). Environmental Systems Div.). Mar 1988. Contract AC21-86MC23275. 91p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE88001096/JAW.

Staged combustion was tested as an approach to controlling NO/sub x/ emissions from ammonia carryover in gasifier fuel streams. Conditions for testing simulated a combined cycle gasifier system with hot-gas cleanup and thus high fuel and air temperatures. Low-Btu GE fixed-bed gasifier and medium-Btu Texaco entrained-bed gasifier gas compositions were tested. Ammonia levels ranged from 500 to 10,000 ppM with 5000 ppM taken as the nominal concentration. Baseline tests were also performed with ammonia-free gas to evaluate thermal NO/sub x/ formation. Catalytic dissociation was also tested as an ammonia removal approach. The catalyst was a platinum/nickel combination on two monolith supports. Staged combustion produced a minimum NO/sub x/ level of 50 ppM (corrected to 15 percent O_2) at about 70 percent theoretical air for the fixed-bed simulated gas and 50 ppM at 50 percent theoretical air for the entrained-bed gas. Ammonia destruction ranged from 95 to 98 percent at the minimum NO/sub x/ condition. With both gas compositions, NO/sub x/ emissions asymptotically leveled off at high inlet ammonia levels. The Texaco medium-Btu gas composition produced a greater fraction of thermal to total NO/sub x/ with 5000 ppM inlet ammonia. The low-Btu GE simulated gas composition yielded only 6 to 40 percent thermal NO/sub x/. NO/sub x/ emissions decreased with longer residence times and higher pressures. 24 refs., 61 figs., 14 tabs.

5747 **(DOE/METC—88/4085) Mild gasification of steam-conditioned bituminous coal in fluidized beds: Technical note.** Gessner, A.W.; Hand, T.J.; Klara, J.M. (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). Feb 1988. 72p. NTIS, PC A04/MF A01 - OSTI. Order Number DE88001017/JAW.

A detailed systems analysis of a commercial-scale mild gasification process has been performed. The process includes (1) a conceptual design of the process, (2) mass and energy balances that were calculated with the use of the Advanced System for Process Engineering (ASPEN) process simulator, and (3) a detailed economic assessment that includes several sensitivity studies. In this conceptual study, 1 million tons per year, dry basis, of Pittsburgh No. 8 coal are conditioned with steam at 700{degree}F for 5 minutes in a fluidized-bed and devolatilized at 1000{degree}F for 3 minutes in a second fluidized-bed. Volatiles are condensed and liquid condensate and gas are separated. Liquid production is 340,000 tons per year (approximately 1,870,000 barrels per year) based on an increased liquid yield due to steam conditioning of 37 weight percent of dry, ash-free coal (DAF). This assumed yield is based on bench-scale experimental results for steam-conditioned coal (Graff 1987). Gas produced in the process is internally consumed for char heating and steam generation. Net char production is 466,000 ton/yr. 27 refs., 3 figs., 3 tabs.

5748 **(DOE/PC/60811—F3) The mobile phase in coals: Its nature and modes of release: A study of the molybdenum catalyzed hydrogenation of coals in the absence of solvent: Final report, Part 3.** Stansberry, P.G.; Derbyshire, F.J. (Pennsylvania State Univ., University Park (USA). Energy and Fuels Research Center). Jul 1988. Contract FG22-83PC60811. 241p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE88013032/JAW.

Several coals of different rank were hydrogenated using an impregnated molybdenum catalyst. It was found that the generation of chloroform-soluble extracts and gases from low-rank coals occurred much more readily than for higher rank coals. Reaction of a low-volatile bituminous coal produced only a low level of soluble products, even in the presence of an active hydrogenating catalyst. The reactivity of the coals attests to the known differences in coal structure. That is, coals of low rank consist of structural units which are less condensed and more aliphatic and are joined by a higher proportion of weak cross-links than coals of higher rank. As rank increases, the ring structures become more polycondensed and are joined by stronger cross-links. An examination of the yields of chloroform-soluble extracts, product distribution, and hydrogen utilization has implied that the generation of soluble materials can be characterized by two regimes of liquefaction. At low conversions, the products were of a high oil to asphaltene ratio which decreased and passed through a minimum upon extended reaction. Consideration of the hydrogen consumption in the region of minimum oil to asphaltene ratio has implied that the release of the mobile phase corresponded to a yield of about 15 to 20% for bituminous coals and 30 to 35% for subbituminous coals. The {sup 1}H NMR analysis of the chloroform-soluble extracts derived from the catalytic hydrogenation of a bituminous coal was found to change in a similar fashion as the product distribution. The soluble products at low and high conversion were more aliphatic in composition than the materials of intermediate conversion. 200 refs., 44 figs., 24 tabs.

5749 **(DOE/PC/70002—T3) Coal liquefaction co-processing: Topical report No. 2.** Gatsis, J.G.; Nelson, B.J.; Lea, C.L.; Nafis, D.A.; Humbach, M.J. (Allied-Signal, Inc., Des Plaines, IL (USA). Engineered Materials Research Center; UOP, Inc., Des Plaines, IL (USA)). 19 Aug 1988. Contract AC22-84PC70002. 203p. NTIS, PC A10/MF A01 - OSTI. Order Number DE88015982/JAW.

The UOP co-processing scheme is a single-stage slurry catalyzed process in which petroleum vacuum resid and coal are simultaneously upgraded to a high quality synthetic oil. A highly active dispersed catalyst is used to enhance operations at moderate reaction conditions. The technical feasibility of this processing scheme was successfully demonstrated in a continuous bench-scale plant, which operated smoothly for 1961 hours on stream. Data needed to establish a firm experimental basis for design and economic analysis of a conceptual commercial facility were generated. Co-processing was found to be sensitive to high severity conditions. Also, a novel method for separating the catalyst/coal solids in the slurry product was developed. Finally, catalyst recovery of greater than 95% was demonstrated. 5 refs., 15 figs., 19 tabs.

5750 **(DOE/PC/70002—T4) Assessment of co-processing economics: Quarterly report No. 14, January 1, 1988--March 31, 1988.** (UOP, Inc., Des Plaines, IL (USA)). 21 Sep 1988. Contract AC22-84PC70002. 26p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003330/JAW.

To assist in the economic evaluation of co-processing, a linear programming ("LP") model of a refinery complex was developed that would allow the upgrading and blending of the co-processed products within the refinery to be analyzed and optimized. The basis for this model is described in the following section. A description of the model then follows in Sections 2.0 and 3.0, and Section 4.0 gives an in-depth comparison of the refinery economics for several cases that have been generated using the LP model. 1 ref., 3 figs., 8 tabs.

5751 **(DOE/PC/70002—T5) Design of conceptual catalyst recovery section: Quarterly report No. 13, October 1, 1987--December 31, 1987.** (UOP, Inc., Des Plaines, IL (USA)). 21 Sep 1988. Contract AC22-84PC70002. 26p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003331/JAW.

The objective of the catalyst recovery design task was to take the laboratory results and translate them directly into a conceptual large-scale commercial design for which capital and operating costs could be estimated. Detailed heat and weight balances were prepared, equipment was specified and cost estimates were generated for a conservative "base case". It became apparent part way through the design effort that the scale up would involve an extremely large amount of equipment and substantial capital costs. A spreadsheet based process and economic model was developed to look at a number of variations from the base case that showed promise for reducing costs. Because of time and budget limitations, detailed design work was not completed for all of these modified cases. Cost and utility estimates were generated by scaling base-case equipment and utility data using the spreadsheet model. Substantial cost reductions were observed in a number of the modified cases, and a "best case" was identified for inclusion in the overall co-processing refinery economic evaluation. 2 refs., 6 figs., 4 tabs.

5752 **(DOE/PC/70810—T1) Solvent-mediated hydrogenolysis in coal liquefaction: Final report, 16 October 1984--28 February 1987.** McMillen, D.F.; Malhotra, R.; Nigenda, S.E. (SRI International, Menlo Park, CA (USA)). Jul 1987. Contract FG22-84PC70810. 113p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE88007424/JAW.

The general goal of this work has been to determine the mechanism(s) of coal liquefaction with donor solvents to aid the search for improved liquefaction technology. Specifically, we have tried to determine the chemical factors that control the transfer of hydrogen from the hydroaromatic solvent, hydrogen gas, and hydrogen-rich portions of the coal structure to the portion of the coal structure undergoing "liquefaction" reactions. To this end, the project has focused on the experimental basis for, and potential impact of, the bimolecular transfer of hydrogen from cyclohexadienyl "carrier" radicals in the respective PCAH-containing liquefaction solvents to aromatic clusters in the coal structure. We have called this reaction radical hydrogen-transfer (RHT). 37 refs., 8 figs., 3 tabs.

5753 **(DOE/PC/90017—T19) Cooperative research in coal liquefaction infratechnology and generic technology development: Final report, January 1, 1987 to April 30, 1988.** Huffman, G.P.; Sendlein, L.V.A. (eds.). (Consortium for Fossil Fuel Liquefaction Science, Lexington, KY (USA)). 10 May 1988. Contract FC22-86PC90017. 233p. NTIS, PC A11/MF A01 - OSTI. Order Number DE88014540/JAW.

The Consortium for Fossil Fuel Liquefaction Science (CFFLS) is a research consortium that includes five universities and a state energy laboratory. The membership is comprised of Auburn University, the University of Kentucky, the University of Pittsburgh, the University of Utah, West Virginia University, and the Kentucky Energy Cabinet Laboratory. The Consortium was formed in 1984 in response to the concern of the faculty and scientists at these institutions over the decline of coal liquefaction research in the United States, particularly long-range, basic research. Significant progress towards these goals was made in the current contract period. Major research accomplishments are presented on coal desulfurization, coprocessing, pyrolysis, enhanced reactivity, characterization, resource evaluation and database development. 108 refs., 90 figs., 38 tabs.

5754 **(DOE/PC/90529—7) Micropore diffusion in coal chars under reactive conditions: Quarterly technical progress report, 15 March 1988--15 June 1988.** Perkins, M.T.; Calo, J.M.; Lilly, W.D. (Brown Univ., Providence, RI (USA). Div. of Engineering). 1988. Contract FG22-86PC90529. 22p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003815/JAW.

The current project is concerned with the development and application of a new technique to measure micropore diffusion under actual gasification conditions. The method is an outgrowth of and related to the transient kinetics approach to the measurement of kinetic rate parameters for char-gas reactions that has been developed in our laboratory. It can be shown that the initial transient behavior of a species introduced as a step-function into a "gradientless" reactor in which char is present, is controlled by the transport resistance offered by the char micropores. Therefore, this data can be analyzed for micropore diffusion time constants. In addition, due to the time-resolved nature of the process in the reactor, the initial diffusion step is separated (in time) from any subsequent gas-solid reaction steps. Therefore, diffusion measurements can be performed under gasification conditions. 13 refs., 7 figs.

5755 **(DOE/PC/90538—8) Use of basic nitrogen to chemically clean coal: Annual report for the period September 1987--September 1988.** Silver, H.F. (Wyoming Univ., Laramie (USA). Dept. of Chemical Engineering). 30 Sep 1988. Contract FG22-86PC90538. 23p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003803/JAW.

The effect of reaction variables and nitrogen compound concentration on the desulfurization and liquefaction of a North Dakota lignite, a Wyoming subbituminous coal and a Kentucky bituminous coal was studied. Two different sterically hindered, basic nitrogen compounds were introduced to the mixture with the coal derived distillate solvent and a series of reactor runs were completed. The nitrogen concentrations studied were 5 wt% and 25 wt% of the total solvent charged to the reactor. Results of these experiments have been analysed to determine if the nitrogen bases had any effect in promoting desulfurization and liquefaction. The addition of tetramethylammonium hydroxide to the solvent slightly increased the pyridine conversion of all the coals. Concentration studies using 2,2,6,6-tetramethylpiperidine showed no beneficial effect on pyridine conversion. Both nitrogen bases studied had no apparent effect on the desulfurization of all three coals. 7 tabs.

5756 **(EPRI-AP—6007-SR) Proceedings: Seventh annual EPRI contractors' conference on coal gasification: October 28-29, 1987.** (Electric Power Research Inst., Palo Alto, CA (USA)). Oct 1988. 389p. (CONF-871095—). Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002432/JAW.

From 7. annual EPRI contractors' conference on coal gasification; Palo Alto, CA, USA (28 Oct 1987).

Integrated-gasification-combined-cycle (IGCC) technology represents a clean and cost-effective generation alternative. Highlights from this 1987 conference included reports of several site-specific US. IGCC studies, initial operating results from the Dow 170-MW and Shell SCGP-1 units, a capital and operating cost analysis for the Cool Water project, accounts of several large projects in the Federal Republic of Germany, materials and environmental studies. Individual projects are processed separately for the data bases.

5757 **(IS-IPRT—2) Iowa State Mining and Mineral Resources Research Institute: Semi-annual report, 1 July 1987--31 December 1987.** Markuszewski, R.; Pedrick, J. (Iowa State Univ. of Science and Technology, Ames (USA). Iowa State Mining and Mineral Resources Research Inst.). Feb 1988. Contract W-7405-ENG-82. 41p. NTIS, PC A03/MF A01. Order Number DE89003768/JAW.

This semi-annual report describes the activities of the Iowa State Mining and Mineral Resources Research Institute (ISMMRRI) at Iowa State University, Ames, Iowa, for the period of July 1, 1987 to December 31, 1987. Thirteen graduate research projects in the areas of Mineral Processing, Mining Engineering, Mineral Characterization, and Mined-Land Reclamation, and Fuel Science are described. The graduate students are associated with several different academic departments and are all minoring in Mineral Resources.

5758 **(NP—9770110) Dry quenching of coke: Operation of a demonstration plant. Final report.** Klein, L. (Ruhrkohle A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1987. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770110/JAW.

A newly developed process for dry quenching of coke using a cooling shaft equipped with watercooled walls was tested at Hansa coking plant, Dortmund. The project in question provided initial testing of this new technology from 1983 to 1986. During commissioning and guarantee testing the fundamental advantages of that new technology have been verified. The operation resulted in highly efficient steam raising, high throughput and good quality of coke produced. After eliminating teething troubles for instance with hot coke elevator, steam superheater and refractory brickwork the plant capacity was optimized. The throughput has been increased up to 74 t dry coke per hour resulting in a steam output of 40,5 t/h. (orig.) With 9 refs., 13 tabs., 19 figs.

5759 **(NP—9770119) Characterization of coals for moving bed gasification processes. Experimental and mathematical simulation of moving bed coal gasification. Final report.** Schaub, G. (Lurgi G.m.b.H., Frankfurt am Main (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1986. 123p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770119/JAW.

Aim of this experimental and modeling study was to improve predictive capability for coal behaviour during gasification in

moving bed reactors. A new method was developed that combines a kinetic reactor model with experimental procedures on a laboratory scale for generating coal-specific model input data. Pyrolysis and gasification experiments with various coals were carried out in a bench scale reactor that allows the experimental simulation of moving bed gasification processes. The resulting coal-specific parameters (such as reactivity) were used as model input data for commercial size gasifiers. Simulation results showed good agreement with operating data for commercial plants. Correlations between laboratory-, bench- and commercial scale were established for reactivity as an important coal property affecting moving bed gasification results. For practical purposes the newly developed method can serve as a tool for example in the design of commercial size gasifiers with extraordinary feedstocks or gasifier conditions, process development in moving bed gasification (e.g. investigation of process sensitivity to coal properties, design and operational parameters). (orig.) With 58 refs., 29 tabs., 36 figs.

0106 Properties

REFER ALSO TO CITATION(S) 5731, 5732, 5733, 5739, 5740, 5741, 5753, 5754, 5757, 5759, 5789, 5797, 5798, 5799, 6152

5760 **(DOE/MC/23065—2624) Effects of moisture on coal feeding: Final report.** Bull, W.R.; Spottiswood, D.J. (Colorado School of Mines, Golden (USA)). Sep 1988. Contract AC21-86MC23065. 80p. NTIS, PC A05/MF A01 - OSTI. Order Number DE88010285/JAW.

The surface moisture of coal consists of the moisture absorbed in the pores and that adhered to the surface. The aim of this study has been to try to determine the individual effects of these two moisture components on the handling properties of a coal. The flowability of pulverized coal, at different levels of moisture content, has been measured using the widely accepted compression and shear method described by Jenike. The results showed that the moistures: total, absorbed, and adhered, had limited significance in the flowability of the coal samples. Instead, the conditioning history of the coal appeared to be the most important factor controlling the handling. 23 refs., 30 figs., 3 tabs.

5761 **(DOE/PC/70773—11) Macromolecular structure of low rank coals and lignites: Report for the period July 1, 1988--October 1, 1988.** Larsen, J.W.; Flowers, R.A. II. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry). 28 Sep 1988. Contract FG22-84PC70773. 8p. NTIS, PC A02/MF A01. Order Number DE89003797/JAW.

Objectives of this research are: to investigate and quantitatively characterize the covalent and hydrogen bond crosslinks in sub- bituminous coals and lignites and to determine how they change with coal rank. Attempts will be made to measure the covalent crosslink density by solvent swelling coals whose hydroxyl groups have been converted to ethers and esters. Swelling in hydrogen bonding and non-hydrogen bonding solvents will be studied in an attempt to characterize the role of hydrogen bond crosslinks. Attempts to swell hydrated coals will be carried out. The coal-coal hydrogen bonds will be investigated using infra-red spectroscopy. 8 refs., 2 figs.

5762 **(DOE/PC/80517—T12) Improving the stability of coal slurries: Final report.** Fogler, H.S. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). Dec 1988. Contract FG22-85PC80517. 99p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89004644/JAW.

Polysaccharides were found to stabilize colloidal dispersions (such as coal particles and polystyrene latex particles) even at high ionic strengths. The stability studies with various kinds of polysaccharides showed that rod-like molecules (such as poly (galacturonic acid) and gum tragacanth) are much more effective stabilizers than highly-branched molecules such as arabinogalactan. This effective stabilization with the rod-like molecules was found to result from the adsorption of polysaccharides on the particles, i.e., the steric stabilization mechanism. The stability depends significantly on the solution pH, the molecular weight and the surface charge of particles. Adsorption isotherms, the zeta potential and the conformation of adsorbed molecules (the steric layer thicknesses) were measured as a function of the solution pH, the molecular weight and the surface charge. Photon correlation spectroscopy studies showed that the conformation of adsorbed molecules is strongly dependent on the solution pH, the molecular weight and the surface charge, suggesting that the dependence of stability on these parameters is due to the change of the conformation of the molecules adsorbed on the surface. In addition, the solution pH has a significant effect on the flocculation behavior of particles and can be modulated to bring about peptization of particles. This type of stabilization is referred to as electrosteric stabilization whereby steric stabilization is induced by changing the electrical properties of the system (the solution pH in this case). 41 refs., 43 figs., 10 tabs.

5763 **(DOE/PC/80522—T6) Metal arene complexes in coal structure determination: Quarterly reports, September 1987--August 1988.** Woolsey, N.F. (North Dakota Univ., Grand Forks (USA). Dept. of Chemistry). Nov 1988. Contract FG22-85PC80522. 9p. NTIS, PC A02/MF A01. Order Number DE89003998/JAW.

The functionalization of the benzylic group of arenechromiumtricarbonyl complexes of hexamethylbenzene and tetralin have been studied. Using butyl lithium to form the anion followed by reaction with butyl borate and then acidic hydrogen peroxide allowed good yields of pentamethylbenzyl alcohol to be formed from hexamethylbenzene. The tetralin complex, however, gave the ring oxygenated phenol rather than 1-tetralol as desired. Preparation of the tricarbonylchromium complex of soluble polybenzyl was carried out. This complex was shown to contain one chromium for every two aryl rings. Modification of the rhodium complex insertion protocol was carried out in an attempt to generate carbon carbon bond insertion. Complete characterization of the product is being carried out. Modifications to facilitate benzylic rather than ring hydroxylation are under investigation.

5764 **(DOE/PC/90508—T7) Continuous thermodynamics and group contribution methods for coal liquids: Annual report, October 1, 1987--October 1, 1988.** Allen, D.T.; Behmanesh, N.; Vajdi, L.E. (California Univ., Los Angeles (USA). Dept. of Chemical Engineering). 1988. Contract FG22-86PC90508. 147p. NTIS, PC A07/MF A01 - OSTI. Order Number DE89002065/JAW.

The goal of this work is to develop a method for interfacing analytical data directly with property estimation methods. The case study to be used in this work is the estimation of thermodynamic properties of coal derived liquids. Structural profiles of narrow-boiling range fractions from three coal liquefaction processes were determined by identifying the major functional groups in the distillates and estimating their concentrations. The structural profiles were based on an extensive set of analytical data including results from elemental analysis, proton nuclear magnetic resonance, mass spectrometry, infrared spectroscopy and liquid chromatography. The functional group distributions were then interfaced with group contribution methods for property estimation. Heat capacities, critical constants, activity coefficients, hydrogen solubilities and vapor pressures were estimated for the narrow boiling fractions. The predictions have been compared to the predictions of more conventional property estimation methods and to experimental data. In addition, sensitivity analyses have been performed to determine which structural features in the coal derived liquids are most important in estimating the values of thermodynamic properties. 55 refs., 8 figs., 50 tabs.

5765 **(DOE/PC/90529—8) Micropore diffusion in coal chars under reactive conditions: Quarterly technical progress report, 15 June 1988--15 September 1988.** Perkins, M.T.; Calo, J.M.; Lilly, W.D. (Brown Univ., Providence, RI (USA). Div. of Engineering). 1988. Contract FG22-86PC90529. 21p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003807/JAW.

It has been established that mass transport in pores of molecular dimensions in coals and coal chars is an activated process. The current project is concerned with the development and application of a new technique to measure micropore diffusion under actual gasification conditions. The method is an outgrowth of and related to the transient kinetics approach to the measurement of kinetic rate parameters for char-gas reactions that has been developed in

our laboratory. It can be shown that the initial transient behavior of a species introduced as a step-function into a "gradientless" reactor in which char is present, is controlled by the transport resistance offered by the char micropores. Therefore, this data can be analyzed for micropore diffusion time constants. In addition, due to the time-resolved nature of the process in the reactor, the initial diffusion step is separated (in time) from any subsequent gas-solid reaction steps. Therefore, diffusion measurements can be performed under gasification conditions. 14 refs., 4 figs.

5766 **(IS—4945) Chemical pretreatment of coal in a stirred ball mill: Fossil energy quarterly report, 1 October 1987--31 December 1987.** Birlingmair, D.; Burkart, L.; Tampy, G.; Pollard, J.; Tholl, G. (Ames Lab., IA (USA)). Feb 1988. Contract W-7405-ENG-82. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003755/JAW.

In this study the separation of minerals from coal has been done after altering the free energy by controlling the electrochemical potential. It was shown that the use of sodium hydrosulfite as a reducing agent resulted in a significant reduction in both sulfur and ash without affecting recovery. The alternation of the surface properties of the particles also affects the properties of slurries containing the particles. Estimates of the relative hydrophobicity of the particles in a slurry were obtained from viscosity measurements, and zeta potential measurements corroborated the results. It has also been shown that even though control of particle surface properties improves beneficiation, liberation characteristics are important. Mineral and pyrite grains cannot be easily separated if they remain associated with the organic portions after size reduction. 9 refs., 11 figs., 5 tabs.

5767 **(IS—4948) Microcharacterization of coal components: Fossil energy quarterly report, 1 October 1987--31 December 1987.** Straszheim, W.E.; Markuszewski, R.; Younkin, K.A. (Ames Lab., IA (USA)). Feb 1988. Contract W-7405-ENG-82. 10p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003752/JAW.

SEM-based association analyses were applied to be characterization of mineral matter and coal for a sample of Sunnyside coal and included the use of X-rays for identifying the mineral phases. A new format has been adapted for reporting the association of coal with mineral particles. The format presents the distribution of sample based on thee fraction of the phases within the sample. The new format permits a reasonable prediction of yield and mineral matter content as compared to standard cleanability tests. Current data are being recast into the new format which will permit further comparisons with conventional cleanability tests. 6 refs., 5 tabs.

5768 **(IS—4949) Development of instrumental techniques for coal surface analysis: Analysis for sulfur forms in coal and on coal surfaces: Fossil energy quarterly report, 1 October 1987--31 December 1987.** Markuszewski, R.; Chriswell, C.D.; Norton, G.A. (Ames Lab., IA (USA)). Feb 1988. Contract W-7405-ENG-82. 6p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003751/JAW.

Work has begun on the compilation of literature information on available methods for determining sulfur forms in coal and pyrite surfaces. Thus far, the results of this work appear to clearly demonstrate the shortcomings of currently available and widely accepted methods for the determination of sulfur forms in coal. Recent work at the Ames Laboratory resulted in a promising new technique for determining sulfur forms in coal based upon the stepwise oxidation of coal with perchloric acid. In addition, a simplified, rapid technique has been developed for the determination of elemental sulfur in coal-derived samples.

5769 **(IS—4950) Development of instrumental techniques for coal surface analysis: Advanced spectroscopic analysis of coal surfaces during beneficiation: Fossil energy quarterly report, 1 October 1987--31 December 1987.** McClelland, J. (Ames Lab., IA (USA)). Feb 1988. Contract W-7405-ENG-82. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003750/JAW.

A new method is being investigated to increase the surface and oxidation specificity of FTIR coal analyses. The method uses a combination of UV irradiation to define and approximately 100-{angstrom} thick surface layer of coal for analysis and spectral subtraction to remove unwanted bulk and nonoxidizing species information from the results. This approach should increase the surface sensitivity of analyses by at least a factor of 100. 1 fig.

5770 **(IS—4960) Development of instrumental techniques for coal surface analysis: Analysis for sulfur forms in coal and on coal surfaces: Fossil energy quarterly report, 1 January 1988--31 March 1988.** Markuszewski, R.; Chriswell, C.D.; Norton, G.A. (Ames Lab., IA (USA)). May 1988. Contract W-7405-ENG-82. 10p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003756/JAW.

Work has continued on the compilation of literature information on available methods for determining sulfur forms in coal and on coal and mineral surfaces. Results continue to demonstrate the difficulties and, at times, inadequacies of currently available and widely accepted methods for the determination of sulfur forms in coal. A preliminary literature review of the applicability of ESCA (electron spectroscopy for chemical analysis), also known as XPS (X-ray photoelectron spectroscopy) for the characterization of sulfur forms on coal surfaces has almost been completed. Results indicate that ESCA has great potential for determining the total surface concentration of sulfur on coal particles as well as determining the concentration of other components of potential interest such as carbon, oxygen, nitrogen, chlorine, silicon, aluminum, iron, calcium and magnesium. Thus far the results of this preliminary literature review indicate the ESCA can be used to differentiate between inorganic and organic sulfur forms on coal surfaces, but it is not altogether certain if the technique can be used to differentiate easily among sulfatic and pyritic sulfur or among different organic sulfur forms at all. 26 refs.

5771 **(IS—4962) Development of instrumental techniques for coal surface analysis: Advanced spectroscopic analysis of coal surfaces during beneficiation: Fossil energy quarterly report, 1 January 1988--31 March 1988.** McClelland, J.F. (Ames Lab., IA (USA)). May 1988. Contract W-7405-ENG-82. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003758/JAW.

In one effort, a nondestructive method was developed for measuring Fourier transform infrared (FTIR) spectra of single coal microspecimens smaller than 100 μm in size. The method is based on using a tungsten needle to electrostatically pick up specimens by means of a microscope and a micromanipulator. The needle assembly is then placed in a photoacoustic detector sampling head for FTIR analysis of the specimen. In a second effort, the analysis of mineral matter was tested by a correlation approach. Known concentrations of quartz and kaolinite were added to a mineral-free New Zealand coal, up to maximum concentrations of 30% by weight. The RMS errors of the analyses were 0.33% for quartz, 0.31% for kaolinite, and 0.99% for total minerals. 3 figs.

5772 **(IS—4963) Microcharacterization of coal components for beneficiation: Fossil energy quarterly report, 1 January 1988--31 March 1988.** Straszheim, W.E.; Markuszewski, R.; Younkin, K.A. (Ames Lab., IA (USA)). Jun 1988. Contract W-7405-ENG-82. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003759/JAW.

New tabular and graphical formats were developed for the reporting of data on coal-mineral association data based on the amount of coal analyzed in the particle. Association analysis results were reported and compared for samples of 30-mesh and 200-mesh Illinois coal. Data from automated image analysis (AIA) documented significantly more liberation of coal from mineral matter for the 200-mesh coal. Association analyses were also applied to samples of 325-mesh coal from three different seams. AIA-measured association distributions showed that association depends more on coal character than on mineral matter content. Estimates of coal recovery and mineral matter content, determined by AIA and expressed as a function of specific gravity, correlated well with results from laboratory-scale cleaning tests. 3 refs., 7 figs., 3 tabs.

5773 **(IS—4964) Development of instrumental techniques for coal surface analysis: Functional group analysis in coal by ^{31}P NMR spectroscopy: Quarterly report, January 1, 1988--March 31, 1988.** Verkade, J.G. (Ames Lab., IA (USA)). May 1988. Contract W-7405-ENG-82. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003760/JAW.

Five phosphorus-containing compounds, desirable as potential reagents for derivatizing labile hydrogen functional groups in coal, on coal surfaces, and in coal-derived materials have been synthesized. These compounds include 2-chloro-1,3-dioxaphospholane (1), 2-chloro-4,4,5,5-tetramethyl-1-1,3-dioxaphospholane (2), 2-chloro-4,4,5,5-tetramethyl-1,3-dioxaphospholane (3), 2-chloro-3-methyl-4-methyl-5-phenyl-1-oxa-3-azaphospholane (4), and 2-chloro-1,3-dithiaphospholane (5). Reagents 1 through 5 have been tested on numerous model compounds including phenols, alcohols, carboxylic acids, amines and thiols to produce ^{31}P nmr spectra useful for identification and eventual possible quantitation. Reagent 5 has been found to greatly exceed our expectations for resolving the individual ^{31}P absorption peaks and for separating the peak ranges for the various classes of derivatized model compounds. 7 refs., 1 fig., 1 tab.

5774 **(IS—4968) Chemical pretreatment of coal in a stirred ball mill: Quarterly report, 1 April 1988--30 June 1988.** Birlingmair, D.; Burkhart, L.; Tampy, G.; Pollard, J. (Ames Lab., IA (USA)). Aug 1988. Contract W-7405-ENG-82. 16p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003762/JAW.

The zeta-potential, pH, and pulp potential were measured as a function of time for organic- and mineral-rich fractions of Upper Freeport run-of-mine coal suspended in aqueous media. Solutions of varying concentration of sodium dithionite (Na{sub 2}S{sub 2}O{sub 4}) and varying pH were used as the suspending media. Samples of different average particle sizes were also studied. The zeta potential of the particles and the pH and electrochemical potential of the slurry varied with time. The variations were influenced by the size of the particles and also by the concentration of reactive species in the suspending media. These results show that the extended contact with the suspending solutions and the decrease in particle size are factors that influence the surface properties of the particles when they are chemically treated during grinding. Earlier work has shown that alteration of surface properties by chemical pretreatment during grinding can lead to improved recoveries during flotation. 7 refs., 8 figs., 2 tabs.

5775 **(IS—4971) Development of instrumental techniques for coal surface analysis: Analysis for sulfur forms in coal and on coal surfaces: Fossil energy quarterly report, 1 April 1988--30 June 1988.** Markuszewski, R.; Chriswell, C.D.; Norton, G.A. (Ames Lab., IA (USA)). Aug 1988. Contract W-7405-ENG-82. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003763/JAW.

The thorough review of all available literature on the determination of sulfur and sulfur forms in coal and on coal pyrite surfaces is proceeding. As of now, about 200 citations through 1984 have been catalogued and reviewed. Work is continuing on the identification, collection, and critical evaluation of more recent literature. Preliminary results have shown that the reaction of coal samples with powdered sodium hydroxide at controlled temperatures could likely lead to the step-wise conversion of sulfur forms from the coal into water-soluble forms. Determination of total sulfur in the reacted coal residues, after removal of these water-soluble sulfur species formed by reactions with the caustic, and calculations (on a common basis) of the percent sulfur removed at a given temperature are anticipated to provide a reasonable and useful indication of the percentage of individual sulfur forms initially present. Subsequent determination of total sulfur in the aqueous solutions removed by water-washing should give similar data to corroborate the conclusions. 17 refs., 2 figs., 1 tab.

5776 **(IS—4972) Development of instrumental techniques for coal surface analysis: Advanced spectroscopic analysis of coal surfaces during beneficiation: Fossil Energy quarterly report, 1 April 1988--30 June 1988.** McClelland, J.F.; Oh, J.S. (Ames Lab., IA (USA)). Aug 1988. Contract W-7405-ENG-82. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003764/JAW.

A new UV-IR analytical method is being developed to measure coal oxidation in 100-{angstrom} thick surface layers. This method has a unique capability to measure oxidation in the processing-sensitive surface layer as opposed to the bulk region which is probed by conventional IR measurements. Test results are reported that show for the first time the presence of increased oxidation in the surface region relative to the bulk for fresh Illinois No. 6 coal surfaces exposed to extremely mild room temperature oxidation. 7 figs.

5777 **(IS—4974) Development of instrumental techniques for coal surface analysis: Functional group analysis in coal by {sup 31} NMR spectroscopy: Quarterly report, 1 April 1988--30 June 1988.** Verkade, J.G. (Ames Lab., IA (USA)). Aug 1988. Contract W-7405-ENG-82. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003766/JAW.

A selection of phosphorus-containing compounds has been evaluated as potential derivatizing reagents for the analysis, by {sup 31}P NMR spectroscopy, of labile hydrogen functional groups in coal-derived materials. These reagents include dioxaphospholanes (1--5), a diazaphospholane (6), dithiaphospholanes (7--9), and a dithiaphosphorane (10). These reagents have been tested on a large number of model compounds and model compound mixtures for their ability to separate the {sup 31}P chemical shift ranges associated with derivatized functional groups (i.e., phenols, alcohols, carboxylic acids, amines, and thiols) and to resolve within these ranges chemical shifts due to the variety of organic substituents on the functional group. Thus far, reagent 7 has been found to yield the best results. Preliminary screening of a low-temperature coal pyrolysis condensate derivatized with 7 demonstrates the potential of this reagent for the identification and possible quantitation of individual heteroatom components in condensates. 9 refs., 3 figs., 1 tab.

0108 Waste Management

REFER ALSO TO CITATION(S) 5963, 5964, 5965, 6096

5778 **(DECG—ESP3/PG/11) Prediction of wastewater characteristics from alkaline combustion wastes.** (Dearborn Environmental Consulting Group, Mississauga, Ontario (Canada)). 1988. 113p. (MICROLOG—88-03676). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G.

Atmospheric fluidized bed combustion (AFBC) is a rapidly developing technology which allows problem fuels to be combusted while achieving strict air emission requirements. The process will likely produce large volumes of waste which are as yet not well understand and for which optimum waste handling and disposal methods have not been identified. For these reasons, residues resulting from the pilot-scale combustion of a variety of fuels, including high sulfur coals and petroleum coke in beds of eastern or western Canadian limestones, were subjected to a characterization program. The program included tests to characterize the physical, chemical, leachate and leachate toxicity properties of the AFBC residues. In addition, simple methods to predict the characteristics of combustion residue-contacted wastewaters were investigated. The effect of contact with the atmosphere on leachate chemistry and toxicity were also studied. The results of the characterization studies were assessed in order to identify variations in wastes and their leachates, the implications of chemical reactions and the environmental consequences of AFBC waste management and disposal. 2 refs. 8 figs., 30 tabs.

5779 **(DOE/PC/80520—T9) Studies on the reaction of calcined limestone with sulfur dioxide: Final report, September 1985--January 1988.** Sotirchos, S.V. (Rochester Univ., NY (USA). Dept. of Chemical Engineering). Apr 1988. Contract FG22-85PC80520. 96p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE88010508/JAW.

Experimental studies of limestone calcination and sulfation were carried out using two naturally occurring stones, a dirty limestone and a dolomitic marble. Experiments included initial pore size distribution measurements of the calcined samples by mercury porosimetry, measurements of the initial internal surface area by N_2 adsorption using a flow-type reaction/adsorption apparatus for gas-solid reaction studies, conversion vs time studies using thermogravimetric analysis, and direct photomirographic examination of the calcined and sulfated samples by scanning electron microscopy. Results showed strong dependence of the sorptive capacity of limestone for removal of SO_2 on the pore size distribution of the calcined product. Various mathematical models developed by our research group for gas-solid reactions with solid product (random pore and random grain models) were used to analyze the conversion vs time data obtained from the sulfation experiments. To investigate the effects of intraparticle diffusional limitations on the sulfation capacity of calcined limestones, experiments were conducted over a rather wide range of particle size and temperature using two high purity limestone samples. Results showed that the evaluation of limestones proposed to be used as sorbents for controlling SO_2 emissions from fluidized-bed combustors should be based on the form of the pore size distribution of their calcined product and not on their average structural properties only. 39 refs., 41 figs., 9 tabs.

5780 **(DOE/PC/90514—T7) Anaerobic fluid-bed treatment of coal conversion wastewater: Eighth quarterly technical progress report for the period May 15, 1988--August 15, 1988.** Suidan, M.T.; Pfeffer, J.T.; Nakhla, G.F.; Traegner, U.K. (Illinois Univ., Urbana (USA). Dept. of Civil Engineering). 1988. Contract FG22-86PC90514. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003336/JAW.

Anaerobic fluidized-bed GAC reactors have been proven successful for the treatment of biologically inhibiting wastewaters such as coal conversion wastewaters. However, in treating such wastewaters which contain compounds that not only resist biodegradation but also inhibit the degradation of other compounds, adsorption on granular activated carbon (GAC) represents a viable strategy for the removal of these inhibitory compounds. Since the adsorptive capacity of the reactor media is limited, partial replacement of the carbon bed is then necessary to maintain the concentration of inhibitory compounds below threshold levels. The cost of the GAC replacement thus represents a major operating cost of the system. The hydraulic detention time and the associated carbon inventory represent the single most important capital cost parameter. The objectives of this research are to determine, using experimental and modeling strategies, the effects of hydraulic detention time and the schedule of GAC replacement on the performance of fluidized-bed GAC anaerobic reactors during the treatment of coal conversion wastewater. 1 ref., 3 figs., 1 tab.

5781 **(DOE/PC/91021—T6) Flue gas cleanup technology utilizing energetic electrons: Technical progress report No. 7, November 6, 1987--February 5, 1988.** Davis, R.H.; Finney, W.C. (ed.). (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1988. Contract AC22-86PC91021. 30p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003340/JAW.

Electron beam precharger technology was advanced this quarter by the progress made in this contract; the development and testing of electron beam precharger designs and the assessment of free electron charging of aerosol particles with the ultimate objective of practical utilization. The geometry of the Mk. III electron beam precharger differs from that of the earlier prechargers in that the ionization zone is recessed, and the electrode configuration for the charging zone is designed for higher charging fields. Definitive measurements of the range of the electron beam were made to confirm that the beam energy and ionization zone geometry satisfy the matching condition. These results are reported under Task A. A significant increase in the charging electric field is produced by the new electrode geometry, and this results in an increase in particle charge by ionic field charging. As mentioned in previous technical progress reports, free electron charging is particularly important to electron beam precharger technology, since free electrons produce a much higher particle charge than do ions. 9 figs., 5 tabs.

5782 **(DOE/PC/91022—T2) An experimental and theoretical study of high-intensity, high-efficiency sirens: A thesis in acoustics.** Pla, F.G. (Pennsylvania State Univ., University Park (USA)). May 1987. Contract AC22-86PC91022. 337p. NTIS, PC A15 - OSTI. Order Number DE89001399/JAW.

High-intensity, high-efficiency sound sources are needed for acoustic agglomeration of particle-laden aerosols in power plant flues and for combustion enhancement. The mechanical design of an experimental and a full-size siren is presented. Tunable inlet chambers are included to minimize the acoustic power radiated backward in the siren. Results show that tunable inlets are most effective at low pressure ratios and low frequencies. The main acoustic losses are discussed. A theoretical study of the sound generation mechanism in sirens is then presented. The various sound attenuation mechanisms are reviewed and a low frequency numerical solution for the frequency response is given. Finite-amplitude sound propagation in a horn is also studied. Results are presented that agree very well with experimental data. Important nonlinear phenomena such as shock formation, acoustic saturation, and distortion of initially non-sinusoidal finite-amplitude waves are discussed. Finally, a new siren design methodology is presented, including a step-by-step discussion on how to minimize the acoustic losses. 126 refs., 70 figs., 7 tabs.

5783 **(EPRI-CS—6029) EPRI High-Sulfur Test Center: Wet FGD [flue gas desulfurization] sodium carbonate mass-transfer tests: Final report.** Jarvis, J.B.; Burke, J.M. (Electric Power Research Inst., Palo Alto, CA (USA); Radian Corp., Austin, TX (USA)). Oct 1988. 278p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001760/JAW.

HSTC contains pilot- and mini-pilot-scale systems for investigating wet FGD technologies, as well as dry-injection and spray-drying pilot systems for investigating dry FGD technologies. A series of sodium carbonate (Na_2CO_3) mass-transfer tests is the first step in characterizing the SO_2 removal capabilities of wet FGD systems at HSTC. By using sodium as the SO_2 absorbent, an excess of liquid-phase alkalinity is provided to assure that gas-limited mass transfer alone will control SO_2 removal. Objectives of this project were to determine the maximum possible SO_2 removal capabilities of the HSTC wet FGD systems under different configurations; to provide data for modeling SO_2 absorption under gas-limited mass-transfer conditions. Sodium mass-transfer tests were conducted using slurry with a high concentration of liquid-phase alkalinity, established by adding sodium carbonate and maintained with a unique, in situ, dual-alkali operating system that continuously regenerated slurry alkalinity with slaked quicklime [$Ca(OH)_2$]. This process allows testing of a slurry, simulating a lime or limestone scrubber, while maintaining an excess of liquid-phase alkalinity to assure gas-limited mass-transfer conditions. SO_2 removal efficiencies were measured of the mini-pilot and pilot systems for three absorber configurations—spray tower, tray tower, and packed tower. More than 300 tests were conducted over a wide range of operating conditions, using various types of spray nozzles characterized for spray distribution patterns. 5 refs., 74 figs., 23 tabs.

5784 **(IS—4953) Stabilization of coal cleaning solid wastes and coal combustion solid and liquid wastes: Progress report, 1 October 1987--31 December 1987.** Burnet, G.; Gokhale, A. (Ames Lab., IA (USA)). Jan 1988. Contract W-7405-ENG-82. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003747/JAW.

The primary objective of this investigation is to stabilize coal cleaning and power plant combustion wastes by aggregation and sintering to form impervious, vitreous granules. The result will be an inexpensive method for eliminating environmental problems caused by dusting, leaching, and smoldering at waste disposal sites. The process will utilize the energy (fuel) and sintering materials inherently present in the wastes. 13 refs., 4 figs., 9 tabs.

5785 **(NP—9770115) Development of a process for depositing fly ashes and other fine-grained combustion residues underground in the cavities of caved-in gobs. Final report.** Arndt, H.J.; Ludwig, G. (Ruhrkohle A.G., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Dec 1986. 24p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770115/JAW.

Due to lacking stocking facilities on the surface and due to the limits set to industrial use, underground cavities in coal mining need to be used in the future for depositing combustion residues from coal firings. This concerns ashes from electro-static filters and gypsum from flue gas desulfurization. Similar problems exist also for coal preparation tailings, e.g. froth flotation sludges. Due to their volume above all the caved-in gobs of coal faces are well-suited for underground disposal, and hydraulic long-range transport to these gobs is cost-effective. However, no experience is on hand as yet whether and in which concentration these matters can be pumped without discharging exessive water into the mine workings, and which pumping pressures are to be expected. Since at present only stepwise progress is possible, a blending and pumping unit was constructed and, after surface testing, fielded to district EF-45 for initial underground trials. In the course of said trials over several weeks 350 t of ashes were injected over several 100 m of pumping length into the gob without water being released to the workings. This proves that this process is feasible. The parameters obtained allow planning of more efficient systems. Prior to construction of centralized long-range pumping systems, however, a number of other questions is still to be answered. (orig.) With 1 tab., 9 figs.

5786 **(NP—9770117) Construction and operation of a pilot plant for treating process waste water from coal hydrogasification. Final report.** Felgener, G.W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1987. 216p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770117/JAW.

Within the scope of this project, a pilot plant was built for treating a partial flow of approx. 6 m/sup 3//h of the process waste water laden with ammonia, hydrogen sulphide, organics, and coal dust. During the test period of some 21 months it was possible to operate all plant units. After having been optimized through extensive structural and process engineering modifications, the flotation unit attained the operational reliability required even under varying input conditions and increased its availability from nearly 70% in the beginning to more than 95% in the last four months. With varying solids contents ranging from 1 to 12 g per l of process water, constant elimination rates of 99.5%.wt were achieved in the test runs. In the wet oxidation unit, a more than 99% degradation was attained even with high hydrogen sulphide concentrations of approx. 400 mg/l. Additional research on the oxidation of carbon compounds was successful at increased operating temperatures and pressures. The wet oxidation unit was available 99.7% of total operating time. To prevent any risk of amonium carbonate clogging, separation of amonia in the stripping column was only performed with concentrations below 200 g NH/sub 3//l in the overhead product. The risk of excessive amonium carbonate formation was also the reason why the distillation of the overhead product to produce enriched water was only possible in a comparatively expensive operating mode using a sodium hydroxide solution to bind carbonic acid. Several test runs in which the bioreactor was operated with process waste water from coal hydrogasification have proved that oxidation of carbon compounds and nitrification produce a waste water quality meeting the requirements for discharge. Various water qualities were passed through the adsorption columns filled with fine coke and activated carbon. (orig.) With 53 refs., 11 tabs., 79 figs.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 5743, 5756, 5757, 5781, 5964

5787 **(ANL/EES-TM—351-Vol.1) Regional emissions data base and evaluation system (REDES): Volume 1, Methodology and user guide.** Boyd, G.A.; VanGroningen, C.; Abel, L. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Jun 1988. Contract W-31109-ENG-38. 32p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002810/JAW.

This report describes an IBM personal-computer (PC) based system designed to aid in the evaluation of proposals to develop and demonstrate new technologies making clean use of coal. It forecasts the emissions that could result from the commercial introduction of a proposed clean coal technology, based on a user-defined market. These emission evaluations for each proposed technology can be saved for future analysis and comparison. The REDES program gives the user a systematic process for entering the characteristics of a particular clean coal technology; it then evaluates and reports on the potential impact that the introduction and commercialization of this proposed technology would have on the environment. In a sense, REDES is like a black box. It will produce evaluations based on any technology characteristics that it receives as input. To help the user of REDES determine the performance that might be expected from these emerging technologies, a set of generic technology characterizations are provided in the data base as a guide (see Vol.3). REDES is written as a run-time module in GURU, an expert system and relational data-base package from Micro Database Systems, Inc. (MDBS) for the IBM PC and compatibles. REDES cannot be executed without the run-time GURU program. This program must be obtained directly from MDBS; it is not available from Argonne National Laboratory (ANL). 15 figs., 5 tabs.

5788 **(ANL/EES-TM—351-Vol.2) Regional emissions data base and evaluation system (REDES): Volume 2, Regional emissions evaluation data base (REED).** Boyd, G.A.; Campbell, A.P.; Davis, M.J.; Veselka, T.D. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 55p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003769/JAW.

A three-volume report has been prepared to document these REDES data bases and computer model. This volume documents the data base for forecasting emissions. This disaggregated forecast data base of energy use and emissions for electric utility and industrial boilers for 1985 through 2010 is called REED (Regional Emissions Evaluation Data Base). The other volumes describe the methodology of the evaluation system and user-driven menu system (Vol. 1) and document the data base that characterizes 21 generic technologies (Vol. 3). All three volumes provide the user with a complete description of REDES, which is designed to forecast the change in emissions that could result from using a particular clean coal technology. The US Department of Energy's Innovative Clean Coal Technology (ICCT) program has solicited proposals from the private sector to demonstrate innovative technologies that allow the clean use of coal as an energy source. The US Department of Energy and the ICCT Source Evaluation Board requested that Argonne National Laboratory develop two data bases and a personal-computer-based model to aid in evaluating the potential for these proposed technologies to reduce environmental residuals. Version 1.0 of the Regional Emissions Data Base and Evaluation System (REDES) is available to the public through the National Energy Software Center. 41 refs., 16 tabs.

5789 **(ANL/EES-TM—351-Vol.3) Regional Emissions Data Base and Evaluation System (REDES): Volume 3, Environmental profiles of selected clean coal technologies.** Poch, L.A.; Gillette, J.L.; Boyd, G.A. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Jun 1988. Contract W-31109-ENG-38. 76p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89003770/JAW.

The clean coal technologies described in this report make use of advanced combustors, alternative fuels, coal preparation processes, fluidized-bed combustors, flue-gas cleanup technologies,

coal liquefaction processes, and surface gasification. Each profile begins with a brief description of the technology, followed by an assessment of its applicability to the utility or industrial sector in terms of fuel sulfur content, boiler size, and boiler market (new, repower, and/or retrofit). The sulfur content of the coal is described as being low, medium, or high. Low-sulfur coal contains less than 1.5% sulfur, medium-sulfur coal has 1.5--3% sulfur, and high-sulfur coal contains greater than 3% sulfur. Boiler size (or unit output of electricity) is discussed in terms of being small, medium, or large. A small boiler has less than 100 MW output, a medium boiler has 100--400 MW output, and a large boiler has greater than 400 MW output. Removal efficiencies or emission levels for sulfur dioxide (SO_2), oxides of nitrogen (NO/sub x/), and particulates are described, as are the anticipated changes in heat rate that would result from the use of each technology. The wastes generated by each technology are also discussed. Following each technology's profile is a bibliography that lists the sources used to compile the values for the various parameters. 49 refs.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 5757

0120 Mining

REFER ALSO TO CITATION(S) 5757

5790 **(NP—9770111) Development of product and procedure for applying mineral foam to backfill roadway linings and constructing dams in coal mines. Short version.** Schumann, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). May 1987. 16p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770111/JAW.

A foaming, powder-type material on a cement basis was developed for backfilling steel linings in roadways and other mine openings. Foaming was achieved by including finely-dosed amounts of air in the wet grout when mixing; after transport through pipes by adding high-pressured air at approx. 4 bar in mixing pipes with quick-rotating beaters or by adding a separate foaming agent to the wet or dry grout. The procedure for manufacturing the mineral foam was developed on a practice-orientated basis and tested underground. Sheets, hoses and cushions made of jute were used for sealing off cavities. The technical and physical characteristics of the set mineral foam were influenced by the intensity of mixing. The compressive strength amounted to up to 10 N/mm/sup 2/ at 50 vol.% air content; the gross density approx. 1 kg/dm/sup 3/. The backfilling mass is compressible, can be plastically formed and briquetted when the operative strength has been exceeded. An even, favorable loading of the support is thereby achieved. Mine openings backfilled with mineral foam show no convergences worthy of mention. (orig.) With 1 tab., 6 figs.

5791 **(NP—9770120) Coal mine of the future. Examples of mining engineering for great depths in operational collieries. Final report.** Claes, F. (Bergbau-Forschung G.m.b.H. Forschungsinstitut des Steinkohlenbergbauvereins, Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1986. 175p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE89770120/JAW.

Problems and approaches for development and coal winning were investigated for colliery takes in great depths within the Ruhr district. By the example of the take of Osterfeld colliery fundamental conditions of strata mechanics, mine support, ventilation, air-conditioning, and methane drainage were determined, and the technically and economically most favourable solutions was looked for. The following approaches turned out to be advantageous: cutting of gateroads in line with the face, Z-type district configuration, highest-admissible ventilation airflow in coal faces in thin seams, and limited, but intensively cooled ventilation airflow in thick seams. A detailed concept for development layout, and infrastructure for panels remote from the shaft in great depths was developed - as example - for Westfalen colliery. Characteristics: great interlevel distance, development by staple shafts, level link-up by drifts, short ventilation airflow distances by correspondingly arranged downcast shafts, rail transport with high payloads at high speeds, possibilities of trackless haulage within the districts. For this planning optimization an EDP system was developed and used for evaluation of this concept, for model planning of new developments, and for comperative assessment of planning alternatives for the extension takes of Walsum colliery. Example: In the northern takes of Bergbau AG Westfalen concepts for an extensive compound with centralized winding and coal preparation was developed with consideration of various sites. For ROM flows of up to 80.000 t/d skip winding or belt drifts to the surface as well as joint or selective coal preparation resulted in a calculated degression of costs. (orig./MOS) With 21 refs., 24 tabs., 33 figs.

5792 **(NP—9770132) Free-steered vehicle technology for transport of personnel, supplies, and mineral wastes within the main road haulage network of Haard extension colliery. Final report.** Einhaeuser, J. (Ruhrkohle A.G., Essen (Germany, F.R.)). (Bergbau A.G. Lippe, Herne (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Ruhrkohle A.G., Essen (Germany, F.R.)). Jan 1987. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770132/JAW.

A transport system was developed which allows personnel and material transport by trackless vehicles in the outbye area (max. 4 km distance from the shaft). The system comprises semi-trailer combinations (approx. 17 t payload) for the pit yard/shaft/pit bottom transport, material transport vehicles (payloads approx. 5 t and 8 t), and shield support transport vehicles (approx. 14 t payload). The vehicles may be run in roadways of $>$ 3 m width and 2.6 m high including inclinations of up to 100 gon corresponds to 17%. Personnel transport is assured by mini-buses (10 seats) or buses with pivot-steering with 16 or 22 seats. The vehicles can also be used in in-seam roadways. Multi-purpose vehicles were not found to be useful. Mineral wastes transport from roadheading is out of question with present-day drive technology because of the large distances ($>$ 7 km), the large quantities involved ($>$ 1000 t/d), and because of excessive emissions from the exhausts. For level roads a practicable floor consolidation method was developed on the basis of concrete casting or mineral-blend techniques. An EDP-based transport model was developed for free-steered vehicle operation. (orig.) With 1 tab., 65 figs.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 5760

5793 **(DOE/PC/90956—T5) Advanced instrumentation for local measurement of gas-solid suspension flows: Quarterly technical progress report No. 6, February 1, 1988--April 30, 1988.** Ling, S.C.; Pao, H.P. (Catholic Univ. of America, Washington, DC). 1988. Contract FG22-86PC90956. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE88015480/JAW.

The development of experimental setup and instrumentation work is nearly completed in this period. The work on sedimentation theory is continued. The whole optical detector will be assembled and tested shortly. The lens system has been designed, machined, and ready for calibration and testing. Photomultipliers have been built. 4 figs.

5794 **(NP—9770112) Vertical cover-belt conveyor for mining industry. Final report.** Finkennest, J.; Bechtloff, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 18 Feb 1987. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770112/JAW.

The continuous vertical conveyance of heterogeneous and adhesive materials over great heights is without problems. The fatigue strength of the foam belt is reached with 5x10/sup 5/ rotations under double reversed bending stresses. The test-plant worked without any problem during the material circulation. Further experience was made with another test-plant as return-loading-plant with cast-wheels. Fields of application: mining industry, silo-technics, loading and unloading of ships.

0140 Combustion

REFER ALSO TO CITATION(S) 5757, 5958

5795 **(DOE/MC/23006—2556) Fluidic fuel feed system: Topical report.** (Adiabatics, Inc., Columbus, IN (USA); Defense Research Technologies, Inc., Rockville, MD (USA)). 11 Dec 1987. Contract AC21-86MC23006. 108p. (AI—AR86145-1287). NTIS, PC A06 - OSTI. Order Number DE88007183/JAW.

This topical report has been prepared by Defense Research Technologies, Inc. in accordance with the statement of work under DOE contract DE-AC21-86MC23006. The purpose is to present the results of the first phase of the Fluidic Fuel Feed System program. The objectives of this Fluidic Fuel Feed System project are to improve the operating life of coal slurry fuel handling, control, and injector component hardware and the atomization process by use of no-moving-parts fluidic devices. Tasks in this project are to develop concepts and to analyze, design, fabricate, test, and evaluate fluidic systems which will control injection of coal fuel slurry into a diesel engine.

5796 **(DOE/MC/23249—2561) Kinetic behavior of solid particles in fluidized beds: Annual report.** Kono, H.O.; Huang, C.C. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). Oct 1987. Contract AC21-86MC23249. 47p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number TI88001061/JAW.

This report summarizes technical accomplishments for the first year in a 3-year contract project for the Morgantown Energy Technology Center (METC) of the US Department of Energy (DOE) under contract number AC21-86MC23249. The objectives of the project are (1) to develop experimental techniques for measuring the forces of fluidized particles, and (2) to predict solid particle performance in fluidized beds using data analysis and mathematical modeling. During the first year, the fracture-sensitive tracer-particle method was developed and applied to investigate the effects of fluidized particle size, superficial gas velocity, bed height, bed diameter, and bed configuration on the kinetic behavior of solid particles in fluidized beds. Quantitative data and comprehensive information were obtained. A piezoresistive strain-gauge sensor and a PC data-acquisition system were also developed; these are being used to measure the force distribution in fluidized beds. The pressure fluctuation method will also be investigated in the near future. 12 refs., 24 figs., 2 tabs.

5797 **(DOE/METC—88/4079) A sampling system for real-time alkali monitoring in high-temperature, high-pressure process streams: Technical note.** Logan, R.G.; Pineault, R.L.; French, W.E. (USDOE Morgantown Energy Technology Center, WV). Mar 1988. 30p. NTIS, PC A03/MF A01. Order Number DE88001069/JAW.

A dual-probe, dual-orifice sampling system was developed for measuring real-time sodium and potassium concentrations in high- temperature, high-pressure process streams. The system was designed to operate isokinetically to ensure the delivery of a representative particle-laden gas stream to the alkali monitor. The sampling system was operated in conjunction with the Morgantown Energy Technology Center's alkali monitors during tests of a bench-scale pressurized combustor. The system proved to be sensitive to small, rapid changes in alkali concentrations and revealed correlations between alkali levels in the process streams and various operating parameters of the combustor. 36 refs., 8 figs., 5 tabs.

5798 **(IS-M—602) The evaluation of midwestern coal and limestone in coal-liquid fuels for fluidized bed combustors.** Brown, R.C.; Buttermore, W.H.; Foley, J.E. (Iowa State Univ. of Science and Technology, Ames (USA)). 1987. Contract W-7405-ENG-82. 26p. (CONF-870324—3). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003732/JAW.

From 12. international conference on slurry technology; New Orleans, LA, USA (30 Mar 1987).

The goal of this research has been to evaluate the use of midwestern coal and limestone in low-cost coal-water-mixtures (CWM) for fluidized bed combustors (FBC). Several mixture formulation parameters have been investigated to determine their effects on fuel rheology and combustion characteristics. These parameters include: coal particle size, limestone particle size, and Ca/S ratio. It appears that acceptable CWM for fluidized bed combustion can be produced from coarse grinds of midwestern coal and limestone without the use of surfactants or stabilizers. 12 refs., 6 figs., 5 tabs.

5799 **(IS-M—613) Development of coal-water mixtures for use in fluidized bed combustors.** Brown, R.C.; Buttermore, W.H.; Foley, J.E. (Ames Lab., IA (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Mechanical Engineering). 1986. Contract W-7405-ENG-82. 15p. (CONF-8609104—3). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003739/JAW.

From 6. international workshop on coal, liquid, and alternate fuels technology; Halifax, Canada (29 Sep 1986).

The goal of this research is to develop low-cost liquid fuel from Iowa coal and limestone resources for use in fluidized bed combustors (FBC). Several mixture formulation parameters have been investigated to determine their effects on fuel rheology and combustion characteristics. These parameters include: coal particle size, limestone particle size, and Ca/S ratio. It appears that acceptable CWM for fluidized bed combustion can be produced from coarse grinds of coal and limestone without the use of surfactants or stabilizers. 11 refs., 4 figs., 4 tabs.

5800 **(NP—9770118) Characterization, modelling and adaptive control of bench-scale fluidized bed combustors. Final report.** Schuegerl, K.; Deinert, J.; Mittmann, M.; Schuette, K.; Weluda, K.D. (Hannover Univ. (Germany, F.R.). Inst. fuer Technische Chemie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1987. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770118/JAW.

A capacitive measuring system consisting of a twin needle probe, which was put into the hot fluidized bed by means of a water-cooled holder, a microprocessor system for data logging and evaluation as well as a host computer were developed for a high-temperature fluidized bed and installed in a bench-scale reactor. The axial distributions of the piercing lengths, frequencies and rising velocities of the bubbles were measured in different radial positions and at different temperatures between 400 and 850/sup 0/C as a function of the fluidized index. At fluidization indices above 4, the gas throughput and temperature influence only weakly the behaviour of the bubbles. However, their dependence on the height above the gas distributor is significant. This dependence was described with a simple relationship. The fluid dynamics of hot fluidized beds was investigated by means of analysis of pressure fluctuations in the fluidized bed and in the freeboard as well as by distributions of residence times of the gas phase and was modelled by a dispersion model and/or a two-phase model. The spacial distributions of the gas compositions in the fluidized bed and free board were measured by using brown coals and coals of different origins as well as anthracite. The results indicate that the volatile components of the coal, which has not been taken into account in the modelling of fluidized bed combustors up to now, strongly influence the combustion processes. (orig.) With 9 refs., 42 figs.

5801 **(NP—9770131) Development of pulverized fuel combustion for small scale units of the heat market. Part: Pulverized fuel burner. Final report.** Luecker, E. (Ruhrkohle Waerme G.m.b.H., Essen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1987. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770131/JAW.

Six pulverized fuel burners were tested on a superheated steam boiler with a capacity of five tph. All tested burners showed a reliable operation of the boiler designed for oil/gas burning without need of any support energy. The fouling could be kept of a low level by simple measures. The burn up rate was high, losses ranged from 1.4 to 5.3 per cent of full scale capacity, depending on the various burners. Control was similar to oil/gas firing. The NO/sub x/-emission standards set by the new TA-Luft could not be met, the lowest-level was produced at 847 mg/m/sup 3/. (orig.) With 11 refs., 8 tabs., 25 figs.

5802 **(UA—9003518) Improved combustion of coal-water slurries: Final report for the 1986--1987 SOMED [School of Mines and Energy Development] project year.** Arnold, D.W.; El-Kaddah, N.H.; Haymon, T. (Alabama Univ., University (USA). School of Mines and Energy Development). 1987. 27p. SOMED, P.O. Box 6282, University of Alabama, Tuscaloosa, AL 35487-6282. Order Number TI89003518/JAW.

A pilot combustor (80 Kilowatts) was constructed to study coal-water-slurry (cws) combustion in either air or an oxygen enriched atmosphere. The purpose of the experiments was to measure flame size and temperature profiles to aid in understanding the factors affecting the combustion of cws. The cws flow rates varied between 11 and 35 pounds per hour and the oxygen concentration varied from 21% to 55%. The temperatures were measured with thermocouples at several radial positions along the axis of the combustor. The flame length and the maximum flame temperature was found to depend on oxygen enrichment in the primary air. The oxygen enrichment had a pronounced effect on the axial and radial temperature distribution. The cws flowrate affected the flame length and axial temperature distribution but had little effect on the maximum flame temperature or the radial distribution. 7 refs., 15 figs.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 5743, 6085

02 PETROLEUM

5803 (CERI—1988, pp 11) **Prospects for oil exploration activity worldwide.** Cazalot, C.P. Jr. (Texaco Overseas Holdings, Inc., Bellaire, TX). 1988. Canadian Energy Research Institute, Calgary, Alberta. (CONF-8809206—; CE—020300).

From 7. CERI international oil and gas conference; Calgary, Canada (18 Sep 1988).

Three key factors are identified that are believed to determine the level of future worldwide oil exploration activity. The most cited factor is the market price for oil and gas; current price levels have led to a lower but more consistent level of exploration and capital investment. A second key factor is the availability of fair and reasonable economic terms coupled with the security and sanctity of contracts. Several examples are presented of how improved contract terms have increased exploration activity and led to discovery of new reserves. The third factor is the availability of prospective areas or opportunities for exploration. An overview is given of the exploratory status of the world's sedimentary basins, and more detailed examination is given of the circum-Arctic area, Europe, Africa, South America, North America, Near and Far East, and Australia.

5804 **(CMO—8304) Introduction to the Draft Resource Management Plan for Lancaster Sound hydrocarbon development.** (Consolidex Magnorth Oakwood, Calgary, Alberta (Canada)). 1983. 79p. (In English and Inuktitut). (CE—02084). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document concerns a draft for a long-term plan for the responsible development of hydrocarbons in Lancaster Sound, Northwest Territories. It is intended to provide a basis for further information acquisition, critical comment, and identification of shortcomings. The scope of the plan covers the following areas: the anticipated pace of exploration and development in the region; federal and territorial development policies; national goals, including fiscal and economic objectives, business development, and Canadian sovereignty; regional planning, including characterization of the region and an outline of the changes and benefits expected to occur with hydrocarbon development; environmental management; technical operations; oil spill risk analysis and contingency planning; past and future research into Arctic offshore hydrocarbon exploration; communications between the hydrocarbon joint venture participants and the local residents and other interested parties; and a proposal for drilling an exploratory well in 1985.

5805 **(PRCF—1988) Our petroleum challenge. The new era.** (Petroleum Resources Communication Foundation, Calgary, Alberta (Canada)). [1988]. 64p. (CE—02030). Petroleum Resources Communication Foundation, 801 - 6th Ave. S.W., Suite #2030, Calgary, Alta., Canada T2P 3W2; $N/C.

This overview of the Canadian petroleum industry and its future prospects begins with a review of the current world oil supply/demand situation. Discussion is made of Canada's remaining petroleum resources and the possible role of oil sands and frontier developments in relieving or postponing future oil shortages. The history of the Canadian industry is outlined, from its earliest beginnings in Ontario to the birth of the modern industry with the discovery of the Leduc fields. An introduction is given to the fundamentals of petroleum geology, mineral and land rights in Canada, well drilling and completion, and enhanced recovery techniques. Simplified descriptions are made of gas processing, oil refining, and the major pipeline systems in Canada. The future direction of the industry, as discussed in this report, seems to lie in increased development of unconventional oil, namely heavy oil, oil sands, and oil from offshore sites in the Arctic and Atlantic. Includes glossary. 93 figs., 2 tabs.

5806 **(SEG—1988) Canadian oil register, 1988-89.** (Southam Energy Group, Calgary, Alberta (Canada)). 1988. 584p. (CE—02031). Southam Energy Group, Suite #300, 999 - 8th St. S.W., Calgary, Alta., Canada T2R 1N7; $110.00 CAN.

This directory is designed to provide access to comprehensive listings of over 4,500 companies and over 17,000 key personnel participating directly or indirectly in Canada's oil industry. Separate sections cover oil and gas producers, explorers and developers; service and supply companies; consultants and consulting services; data processors; engineers, pipeline contractors, designers, and fabricators; financial and investment sources; geophysical data brokers and contractors; lease brokers and land agents; oil well drilling contractors; oil well servicing companies; pipeline companies and power distributors; petrochemical producers, refiners, processors, marketers and plant operators; transportation and oilfield construction companies, and government departments, associations, and clubs. Includes a general index.

0201 Reserves

5807 **(DOE/EP/31111—T1) Summary report of the activities of the Louisiana Department of Wildlife and Fisheries.** Hanifen, J.; Foote, K. (Louisiana State Government, Baton Rouge (USA); McNeese State Univ., Lake Charles, LA (USA)). 23 Sep 1987. Contract FG01-83EP31111. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003876/JAW.

This document contains a historical summary of the Calcasieu Lake project. The detailed project report is contained in several volumes that were processed separately for the data base. (TEM)

5808 **(ORNL—6517) Navy Mobility Fuels Forecasting System Phase 4 report.** Das, S.; Hadder, G.R.; Leiby, P.N.; Lee, R.; Davis, R.M. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 126p. NTIS, PC A07/MF A01 - OSTI. Order Number DE89004262/JAW.

The Department of Navy's Maritime Strategy is designed to maintain military readiness and the ability to operate in all major theaters of the world. Mobility fuels required for sea, air, and land operations are vital components of the Navy's peacetime and wartime strategies. The purpose of the Navy's Mobility Fuels Technology Program is to understand fuel supply and fuel property impacts on Navy equipment performance and fleet readiness and operations. Oak Ridge National Laboratory (ORNL) has assisted the Department of Navy in developing and testing a methodology for forecasting mobility fuel availability, quality, and relative price, as well as evaluating options to increase fuel supplies during world oil supply disruptions. Publicly available models developed by the Energy Information Administration of the Department of Energy were selected as the foundation of the Navy Mobility Fuels Forecasting System (NMFFS). The NMFFS was enhanced as ORNL

reviewed data on world oil reserves, production and prices, trends in crude oil and refined product quality, and changes in refinery process technology. The system was used to analyze the availability, quality, and relative price of military fuels that could be produced in several domestic and foreign refining regions under Business-As-Usual (BAU) and two hypothetical world crude oil disruption scenarios in the year 1995. 25 refs., 11 figs., 29 tabs.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 5818

5809 (UCID—21303-88-3) Petroleum geochemistry project: Quarterly report, July--September 1988. Braun, R.L.; Burnham, A.K.; Sweeney, J.J. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003718/JAW.

The objective of this work is to develop and test chemical kinetic models of oil generation and expulsion. The work has several components: experiments to understand the mechanisms and kinetics of oil generation, development of computer programs for analyzing experiments and applying chemical kinetics and thermodynamics in a geological environment, and comparison of predictions of chemical/geological models to field data. Some aspects of this work are part of a joint research project with INTEVEP, S.A., in which model predictions will be tested in the Maracaibo Basin. Other aspects are being done with partial support from an industrial sponsorship program. 7 refs., 14 figs., 3 tabs.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 5832, 6088

5810 (DOE/BC/10830—7) A review of the West Sussex Unit CO_2 flood project. Dauben, D.L. (K and A Technology, Tulsa, OK (USA)). Nov 1988. Contract AC19-85BC10830. 31p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89000705/JAW.

Conoco, Inc. conducted a miscible CO_2 pilot flood in the Shannon Formation of the West Sussex Unit, Johnson County, Wyoming. The unit is located in the western edge of the Powder River Basin and consists of a highly faulted anticlinal structure in which hydrocarbons are trapped. The field has been extensively depleted through primary recovery operations and by a successful waterflood. The purpose of the pilot project was to determine if CO_2 flooding will recover sufficient quantities of tertiary oil to be economic. Our review indicates that the project was well designed and implemented. The project yielded an oil recovery response. However, questions have been raised as to the relative contributions of Co_2 and water injection on the oil recovery response. The project is considered to have potential for expansion. However, the prospects are hampered by the lack of a nearby CO_2 source. This project, as well as others, points out the need to develop CO_2 resources on a local basis using advanced design processing and available energy resources such as natural gas, coal, and lignite. 2 refs., 10 figs., 4 tabs.

5811 (DOE/BC/10830—8) A review of the Loudon surfactant flood pilot test. Dauben D.L. (K and A Technology, Tulsa, OK (USA)). Nov 1988. Contract AC19-85BC10830. 33p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89000706/JAW.

A review of the performance of the Loudon Surfactant Flood Pilot Test has been completed. This project was conducted by Exxon in the Loudon Field, Fayette County, Illinois, beginning in 1981. The project was conducted in a 0.68 acre 5-spot pattern, using four injection wells, one central producer, five observation wells, and one post-project cored well. The microemulsion was designed to be effective in the presence of the highly saline formation water (104,000 ppM TDS). No preflush was required. The project was very well designed and executed. The pilot represents a breakthrough in technology and opens up the possibilities of using similar technology to recover oil from other relatively shallow, low-pressure reservoirs. 4 refs., 6 figs., 3 tabs.

5812 (DOE/BC/10847—10) Enhanced oil recovery through in-situ generated surfactants augmented by chemical injection: Annual report for 1986--1987. Wasan, D.T. (IIT Research Inst., Chicago, IL (USA)). Nov 1988. Contract AC19-85BC10847. 124p. NTIS, PC A07/MF A01 - OSTI. Order Number DE88001249/JAW.

We present results of our theoretical and experimental studies in alkaline flooding. The objectives of our work were: (1) to experimentally verify the fractional flow model that was presented in the last annual report, (2) to extend the interfacial activity model previously developed by us to account for the chemistry of the micelle formation in both oleic and aqueous phases for the determination of interfacial tension, (3) to develop a noninvasive technique to characterize oil-water emulsion systems based on dielectric properties, and (4) to investigate solid/fluid interactions in the presence of surfactants, alkali and electrolytes. Results are summarized. 73 refs., 40 figs., 1 tab.

5813 (DOE/CE/15213—T1, pp 34, Paper A) Evaluation of T75 and T120 alloys in H_2S and CO_2 environments: Final report. Colwell, J.A. 1987. NTIS, PC A06/MF A01. Order Number DE88015773/JAW. Contract FG01-85CE15213.

In Aluminized low alloy steels in oil well production.

A. Two new proprietary alloys (coatings), T75 and T120, developed by A.T. Rallis, were evaluated in simulated sour production environments. There were no failures in NACE tensile tests. Stresses up to 99 percent of the yield strength were investigated for the T120 alloy and up to 92 percent for the T75 alloy. However, slow strain rate testing did show a susceptibility for cracking in the environments tested. Weight-loss corrosion experiments showed fairly high rates of attack at elevated temperatures, but longer exposure times would be expected to show lower rates

5814 (DOE/CE/15213—T1, pp 71, Paper B) Sulfide stress cracking studies on aluminized steels. Gundiler, I.H. 1987. NTIS, PC A06/MF A01. Order Number DE88015773/JAW. Contract FG01-85CE15213.

In Aluminized low alloy steels in oil well production.

Aluminizing studies on AISI 4140 and 1045 steels were conducted in laboratory and the factors affecting the aluminized layer thickness were investigated. Aluminized tensile specimens were tested under constant load in standard NACE solution did not fail in 720 h, whereas quenched and tempered steel specimens at comparable strength levels failed within a few hours. Aluminized pony rods, manufactured by A.T. Rallis and tested in production wells by W.W. Weiss, were also studied and characterized. 15 refs., 26 figs.

5815 (MEM/P—1987) 1987 Annual production statistics report [Manitoba]. (Manitoba Dept. of Energy and Mines, Winnipeg (Canada). Petroleum Div.). 1987. 146p. (MICROLOG—88-02900). Manitoba Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, Man., Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents numerical data on Manitoba crude oil production. Data are printed in a field/pool code format, which groups wells according to the field in which they are located and by the pool from which they produce or to which they dispose or inject. Within each pool, unitized operations are shown, followed by non-unit wells within the pool, grouped by operator. Oil production figures and salt water production figures are shown in cubic meters, on a cumulative and monthly basis. All production from confidential wells is shown as a total number only. 3 figs.

5816 (NIPER—338) Steamflooding light crude oil reservoirs: A state-of-the-art review: Topical report. Strycker, A.; Sarathi, P. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 48p. NTIS, PC A03/MF A01 - OSTI. Order Number DE88001238/JAW.

An investigation into light oil steamflooding was initiated to determine if the advantages of using steam to recover crude oil as

demonstrated with heavy crude oil reservoirs could be successfully applied to light crude oil reservoirs. The first phase of this investigation involved a search of the available literature to determine the state-of-the-art in light oil steamflooding. Reports on field tests, laboratory investigations, and simulation studies of light oil steamfloods were obtained and reviewed. Also, steamflooding experts were consulted when necessary to obtain information not available in the public domain. This document, which summarizes the findings, is divided into five primary sections: literature reviews, field projects, research projects, discussion, and conclusions. 96 refs., 2 tabs.

5817 **(NIPER—339) Crosslinking dry xanthan gum for profile modification in oil reservoirs: Final report.** French, T.R.; Gao, H.W.; Bertus, K.M. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 30p. NTIS, PC A03/MF A01 - OSTI. Order Number DE88001239/JAW.

When large areas of oil saturation remain unswept in a petroleum reservoir, profile modification is necessary to redirect injected fluids into areas of high oil saturation. Gels made from xanthan biopolymer that is produced and transported to the field site as a liquid broth have been used for profile modification in many field projects. This report discusses the use, for profile modification treatments, of xanthan biopolymer that is produced and transported in dry, solid form. The report is divided into three sections. Section I covers mixing procedures, section II covers crosslinking procedures, and section III addresses injection strategies. The effects of reactant concentrations, pH, and salinity on crosslinking were investigated. The optimal conditions for crosslinking the powdered xanthan were identified for gel injection and for in situ gelation. The optimal concentration of polymer was found to be in the 1400 to 2000 ppM range. The transition zone from solid to pourable gels occurs at about 20 ppM chromium concentration. 20 refs., 10 figs., 14 tabs.

5818 **Effect of pore structure on miscible displacement in laboratory cores.** Bretz, R.E.; Specter, R.M.; Orr, F.M. Jr. (New Mexico Inst. of Mining and Technology (US)). *SPE (Society of Petroleum Engineers) Reservoir Engineering;* **3**: No. 3, 857-866(Aug 1988).

Observations of pore structure in thin-sections are related to the performance of stable, first-contact-miscible displacements in reservoir cores and then to simulations of displacement performance of CO/sub 2/ corefloods. Results of effluent composition measurements are reported for miscible displacements in seven core samples - three sandstones and four San Andres carbonates from west Texas or eastern New Mexico. Those displacements are interpreted by fitting the measured effluent compositions to the Coats-Smith (C-S) model, which represents the flow as occurring in flowing and stagnant fractions with mass transfer between them. Observations of thin-sections, including measurements of pore-size distributions and a simple measurement of spatial correlation of pore sizes, are also reported. Comparison of displacement results and thin-section data indicates that wide pore-size distributions and preferential flow paths are characterized in the C-S model by high dispersion coefficients and low flowing fractions. Simulations of the interactions of phase behavior and flow in nonuniform pore structures indicate that wide pore-size distributions and preferential flow paths can significantly increase residual oil saturations (ROS's) in CO/sub 2/ floods over those for uniform pore structures. Thus, heterogeneities observable at the scale of a thin-section have significant effects in laboratory core but much smaller effects in displacements at field scale. Large-scale heterogeneities present in field floods, however, probably cause similar increases in residual saturation in some fields.

5819 **Chromatographic transport of alkaline buffers through reservoir rock.** Jensen, J.A.; Radke, C.J. (Serck Baker, Huntington Beach, CA; Univ. of California, Berkeley, CA (US)). *SPE (Society of Petroleum Engineers) Reservoir Engineering;* **3**: No. 3, 849-856(Aug 1988).

Use of relatively low-pH alkaline buffers, such as sodium carbonate or sodium silicate, is explored as a means for overcoming sodium/hydrogen ion-exchange delay in alkaline waterflooding. A local-equilibrium chromatographic model is outlined to describe the concentration velocities for injection of alkaline buffers into a linear porous medium that exhibits reversible sodium/hydrogen exchange. The theory predicts a buffer ion-exchange wave that is substantially faster than that for equivalent-pH sodium hydroxide solutions. New experimental displacement data are presented for NaOH over a pH range from 11 to 13 and for 0.1, 0.5, and 1.0 wt% Na/sub 2/CO/sub 3/ flowing through a 1 wt% NaCl brine saturated Berea sandstone core at 50°C [122°F]. To permit a complete description of the system, column effluent concentrations are measured for sodium ions, hydroxide ions, H/sup 3/-tagged water, and /sup 14/C-tagged carbonate. The experiments confirm that Na/sub 2/CO/sub 3/ propagates through the Berea sand at a higher rate than NaOH. For example, at pH=11.4, Na/sub 2/CO/sub 3/ migrates with a velocity that is 3.5 times faster than NaOH. Comparison of experiment with the ion-exchange chromatography theory shows good agreement. The authors successfully model the concentration histories of tritium-labeled water, total carbon, sodium, and hydroxide, all with no adjustable parameters. This work establishes with both theory and experiment that buffered alkali significantly increases the propagation speed of hydroxide in reservoir sands in comparison with unbuffered alkali at equivalent sodium and hydroxide concentrations. Because lower-pH buffered alkali can also protect against rock dissolution loss, the validated reduction of buffer ion-exchange lag considerably improves the promise of the alkaline flooding process for field application.

5820 **Experimental determination of gas-bubble breakup in a constricted cylindrical capillary.** Gauglitz, P.A.; St Laurent, C.M.; Radke, C.J. (Chevron Oil Field Research Co., La Habra, CA (US)). *Industrial and Engineering Chemistry Research;* **27**: No. 7, 1282-1291(Jul 1988).

To gain insight into the mechanisms of gas-foam generation in porous media, this work quantifies how smaller bubbles snap off from a single, larger bubble as it moves through a smooth, cylindrical constriction. Time to snap off, generated bubble size, and bubble velocity are obtained from viewing 16-mm movies taken of snap-off events. The bubble capillary number, Ca/sub Γ, is varied from 10/sup -5/ to 5 x 10/sup -2/. The authors study two narrowly constricted capillaries of different tube radii (neck radius/tube radius of 0.17 and 0.20) and one widely constricted capillary (neck radius/tube radius = 0.40). In the widely constricted capillary, time to breakup is proportional to Ca/sub Γ/sup -2/, and the generated bubble length is proportional to Ca/sub Γ/sup -1/. In the narrow constrictions, the same results apply above Ca/sub Γ = 5 x 10/sup -4/; below this critical Ca/sub Γ, time to breakup is independent of Ca/sub Γ but depends on the Ohnesorge number. Snap-off behavior with surfactant solutions is found to be similar to that in surfactant-free solutions.

0204 Processing

REFER ALSO TO CITATION(S) 5749, 5750, 5751, 5753, 6136

5821 **(NP—9770146) Continuous pressure hydrogenation of a vacuum residue in a hydrogen and synthesis gas atmosphere.** Boeller, K.D. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 5 Aug 1987. 185p. (In German). NTIS (US Sales Only), PC A09. Order Number DE89770146/JAW.

The author intended to find alternatives to the conventional pressure hydrogenation process in a hydrogen atmosphere. Particular interest was taken in the use of synthesis gas as reaction gas, low-cost one-way catalysts, and sulphur compounds. High-pressure hydrogenation experiments were carried out on a vacuum residue in a hydrogen or synthesis gas atmosphere. Apart from a one-way catalyst (red matter), also brown coal coke and brown coal coke with an iron sulfate film deposited on it were used. The effects of H/sub 2/S-containing product gases on the conversion into distillable oil were investigated. It was found in all experiments that high temperatures and long times of residue are required even with catalytically active components.

0205 Products And By-products

REFER ALSO TO CITATION(S) 5830

0206 Health And Safety

5822 **(PACE—8712) A study of exposure to motor gasoline hydrocarbon vapour at service stations.** (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1987. 35p. (CE—02066). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $10.00 CAN.

A study was undertaken to assess service station attendants and self-serve customers' exposures to gasoline vapours during normal activities. The first phase, a pilot study, is the subject of this preliminary report. The purposes of this pilot study were to verify the efficacy of the sampling method, to identify and resolve problems in the analytical method, and to evaluate the performance of the selected analytical laboratory. Field sampling took place at full-service outlets in Toronto during April 1985. The four participating member companies followed the standardized sampling protocol. Samples were analyzed at a Canadian occupational health laboratory and a research institute in the USA. The results of exposure to airborne concentrations of gasoline components at service stations compare well with results in the published literature. The distribution of the airborne concentrations of individual gasoline components appears to be lognormal, as exemplified by the distribution of the airborne concentrations of toluene. Such a distribution is expected for occupational hygiene sampling results. It was concluded that the sampling method is acceptable for the purposes of this study. To minimize migration of hydrocarbon components, it was recommended that future samples should be refrigerated or delivered to the analytical laboratory in this state, as soon as possible following sample collection. The analytical method was found to be capable of adequately resolving the components of interest. The Canadian laboratory fared well in the interlaboratory comparison and had acceptable analytical precision. 8 refs., 15 figs., 3 tabs.

5823 **(PACE—8712) A study of exposure to motor gasoline hydrocarbon vapours at service stations. Phase 2. Summer study.** (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1987. Vp. (CE—02065). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $10.00 CAN.

An evaluation was made of motor gasoline vapour exposures at service stations within Canada to assist with an assessment of the health risk of gasoline vapours. The study determined motor gasoline vapour exposure of full-serve attendants (pumpers) and self-serve kiosk operators. Self-serve customer exposure was approximated by short term measurements during automobile refuelling. Area samples were taken at the service station lot lines. Bulk samples of gasoline being pumped were also obtained. This report summarizes the second phase of the study, which evaluated exposure to summer grade gasoline vapours during summer weather conditions. The field sampling was undertaken in five Canadian cities. A standardized sampling and analytical protocol using a 600 mg charcoal tubes and capillary gas chromatography with flame ionization detection was followed. The results show that the average airborne concentration of the 55 gasoline components analysed did not exceed one half of the applicable exposure limits. For kiosk operators and pumpers there is high probability (95%) that their exposure to total hydrocarbons, a measure of total gasoline vapour exposure, is only one third of the gasoline exposure limit. For both pumpers and kiosk operators, the eight hour benzene exposure was found, at 95% probability level, to be less than the most stringent Canadian and American occupational exposure limits, as were short term benzene exposures. These results indicate a low probability of gasoline vapour overexposure for the occupations of kiosk operators and pumpers. They also suggest that public exposures to gasoline vapours would be quite low. 12 refs., 32 figs., 15 tabs.

5824 **(SMA—1987) A study to identify inventory control procedures at commercial service stations in the Edmonton area.** Marsh, J.R.; Dycstra, C. (Sereda, Marsh and Associates Ltd., Edmonton, Alberta (Canada)). 1987. 41p. (MICROLOG—88-01541). Alberta Environment, Research Management Division, Publications Office, 14th. Floor, Standard Life Centre, 10405 Jasper Ave., Edmonton, Alta., Canada T5J 3N4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report contains a survey and summary relating to inventory control and reconciliation procedures at urban commercial gasoline service stations in the Edmonton area. The main objective of the survey was, with emphasis on inventory control, to determine if retail gasoline service stations were completing a daily inventory stock of their underground gasoline storage tanks in compliance with Section 219(1) of the Alberta Fire Code and thereby identify where potential problems may exist. A secondary objective was to determine if station operators/managers were current in Fire Safety Training and other provisions of fire awareness relating to the Fire Code. The study concludes that although the service station managers feel they have a good awareness of the Fire Code, there are areas of the Code unfamiliar to them, and it is recommended that owners and operators be sent information from the Fire Commissioner. For independent station owners, some form of training on the reconciliation process should be initiated. 3 tabs.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 6085

5825 **(DOE/EI/20467—T1) Wisconsin fuel oil price and inventory: Final report 1987--1988 heating season.** McCormick, C.J. (Wisconsin Dept. of Administration, Madison (USA). Div. of Energy and Intergovernmental Relations). May 1988. Contract FC01-87EI20467. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003350/JAW.

In August 1987, the US Department of Energy (DOE) provided the Wisconsin Division of Energy and Intergovernmental Relations, Energy Bureau (WEB) a grant to monitor the price and the inventories of No. 1 and No. 2 fuel oils within the state of Wisconsin. During the 1985--1986 heating season, the inventory survey included No. 4 oil. No company in Wisconsin reported an inventory of No. 4 fuel oil during the 1985-1986 or the 1986-1987 survey. Most of these companies had not maintained an inventory of No. 4 fuel oil for many years. This year, earlier spot inquiries showed the same absence of No. 4 oil inventories. 7 tabs.

5826 **(DOE/EI/20472—T1) Michigan residential heating oil survey: Final report, Winter 1987--1988.** Stanton, T.; Pillon, J.; Burrill, J.; Greer, L.; DeBrabander, K.; Derry, D. (Michigan Public Service Commission, Lansing (USA)). 26 Aug 1988. Contract FC01-87EI20472. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003993/JAW.

This report summarizes information on home heating oil prices and inventories over the 1987/88 heating season in Michigan.

5827 **(DOE/EIA—0109(88/09)) Petroleum supply monthly, September 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 23 Nov 1988. 117p. NTIS, PC A06/MF A01 - GPO - OSTI. Order Number DE89003845/JAW.

Total US demand for petroleum products (measured as product supplied) averaged 16.8 million barrels per day in September 1988, about 0.6 million barrels per day below the level for August and over 0.1 million barrels per day above the level for September 1987. Through the first 3 quarters of 1988, total product supplied averaged 17.0 million barrels per day, 2.3 percent higher than during the same period of 1987. Decreases in demand for residual fuel oil, motor gasoline, and asphalt and road oil accounted for most of the drop in total product supplied this month. Other highlights for September 1988 include: Total product stocks increased for the third consecutive month, rising 8.9 million barrels to 744.3 million barrels. Crude oil stocks, excluding the Strategic Petroleum

Reserve (SPR), dropped for the third straight month. Stocks decreased 4.7 million barrels to 328.4 million barrels. Refinery utilization decreased from a rate of 87.4 percent in August to 83.7 percent in September. 12 figs.

5828 **(IFP—36-065) Method of functional modules applied to investment cost estimation. Case of petrochemical units.** Bergman, J. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison; Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France)). Jun 1987. 223p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755594/JAW.

Application of statistical methods of data analysis on a large information sample allows the development of a new method for fast estimation of investment cost. Practical application is based on the following elements: flowsheet, nature of treated products, material balance and operating conditions. Results can be obtained by equations programmed on a small computer or with charts given in this work.

5829 **(OPEC—9003809) OPEC [Organization of the Petroleum Exporting Countries] annual statistical bulletin, 1987.** (Organization of the Petroleum Exporting Countries (OPEC), Vienna (Austria)). 1987. 156p. NTIS (US Sales Only), PC A08 - OSTI. Order Number DE89003809/JAW.

Following upon the traumatic events which characterized the international oil markets in 1986, when crude prices plunged in mid-year to below $10.00 a barrel, 1987 began auspiciously foe OPEC's unremitting efforts to restore stability to the price scene. The Organization's decision in December 1986, to return to a fixed-price system for crude at an average of $18.00 a barrel, and agreed production levels for individual Member Countries, and for OPEC as a whole, undoubtly served to steer the oil industry away from the unprecedented turbulence of 1986 into calmer waters in the new year. The $18-a-barrel price was welcomed and regarded as being sustainable, both for OPEC and non-OPEC oil producers, and for the suppliers of other forms of energy. And in the early months of 1987, OPEC's strategy proved manifestly successful: prices rose dramatically, reaching levels equal to, and sometimes surpassing OPEC's reference price. Its credibility restored, the Organization looked forward to making progress towards its goal of sustainable oil prices in a stable environment. But the oil market is a highly sensitive barometer, which reacts quickly to the slightest pressure. Alas, in the second half of the year, disturbing trends emerged, indicating that the healthy upward movement of prices was being undermined: over-supply, fed by increased production on the part of non-OPEC producers, accelerated oil stock build-up by consumers are a time of increased tension in the Gulf, and, unfortunately, over-production on the part of some OPEC Members, combined to threaten the new-won stability.

5830 **(PACE—8806) Canadian diesel fuel sulfur cost survey.** (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1988. 31p. (CE—02062). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $10.00 CAN.

A survey was commissioned of Canadian refineries to determine the cost impact of a possible reduction in the sulfur specification of highway diesel fuel to 0.05 wt% from the current 0.5% normal maximum. An intermediate 0.15% level is also considered in order to provide data on cost vs degree of S reduction. In order to reduce the S content of diesel, economics dictate new refinery processing facilities that will also reduce S content of non-highway diesel fuels and of a portion of the light fuel oils consumed in Canada. Virtually all respondents indicated that it is not economically attractive to provide further segregation in the overall system. Current crude consumption patterns have been assumed in this survey. Most refineries will require new process facilities and/or major revisions to existing desulfurization facilities. There is a pronounced difference in capital needs between 0.15 and 0.05 S contents, since an 0.05 specification will require diesel fuel components to undergo hydrodesulfurization. In the 0.05 case, the estimated cost per tonne of S recovered as a result of the change in fuel specification is ca $12,600, and the incremental fuel cost to the consumer is 2.9 cents per liter, with total capital required of $972.3 million and annual operating costs of $113.5 million. It is probable that non-highway diesel users, and some light fuel oil users, especially in the west and outside major urban areas in eastern Canada, will share in the added cost due to the normal commonality of product and the difficulties in distinguishing between highway and many off-road uses. 3 refs, 2 figs., 9 tabs.

0208 Waste Management

5831 **(PACE—8712) Waste management guidelines for petroleum marketing operation.** Budzik, P.T. (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1987. vp. (CE—02059). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $100.00 CAN.

The objective of this manual is to provide guidance to the management, environmental personnel and supervisors of petroleum marketing facilities in Canada regarding wastes associated with such facilities. The main focus of the manual is the section on waste data sheets containing general information, physical/chemical data, hazard information, handling and storage, transport, and traetment/disposal guidelines. Wastes are classified as storage/handling wastes, facilites/process waste, automotive waste, and miscellaneous, e.g. cans and bottles. The manual also provides an overview of Canadian legislation on the subject, offers examples of in-plant policies and procedeures to be followed and addresses classification, transportation, treatment technology and disposal methods. Appendices present additional sources of information, including a listing of used oil reclamation facilites and environmental agencies, a glossary and a bibliography, 65 refs., 7 figs., 5 tabs.

5832 **(ZE—C08530740-5-9111) Membrane processing of oil field produced water for enhanced oil recovery (EOR) steam generation. 2 Vols.** (Zenon Environmental, Inc., Burlington, Ontario (Canada)). 1987. 376p. (MICROLOG—88-02161). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Cross flow ultrafiltration systems may provide a valuable alternative to conventional treatment of oil field produced water emulsions. Samples of produced water were obtained from different enhanced recovery sites in Canada for initial characterization and further testing using flat sheet membrane test cells and water samples at different temperatures. In these tests, the highest flux obtained was slightly over 1.0 m/sup 3//m/sup 2//d with no improvement in membrane performance at elevated temperatures. A similar water sample containing 1700 mg/l oil was tested using tubular membrane modules, of 6 different chemical formulations, with much higher levels of turbulence than the flat sheet cell. In these tests, stable flux rates of 5.0 m/sup 3//m/sup 2//d were obtained with several membranes tested. All membranes rejected nearly all suspended oil and solids. A thin film was chosen for further work due to its stable flux and superior rejection characteristics. Experiments conducted with produced water from 8 different sites showed that performance of the membrane system is very site specific and relates to the stability of the emulsion. A final set of tests were conducted to optimize a number of factors affecting system performance including the membranes used, the operating strategy, and the water chemistry. An economic assessment showed that the treatment cost, using ultrafiltration, is comparable with conventional treatment at flux rates over 3 m/sup 3//m/sup 2//d. Significant improvements can be made by reducing the cost of membrane modules and by increasing flux rates obtained. 1 ref., 57 figs., 166 tabs.

0209 Environmental Aspects

5833 **(CONF-8803176—1) Environmental protection and the petroleum industry - a European challenge.** Krueper, M. (VEBA-Oel A.G., Gelsenkirchen (Germany, F.R.)). (Mineraloelwirtschaftsverband e.V., Bonn (Germany, F.R.). Buero Bonn; VEBA-Oel A.G., Gelsenkirchen (Germany, F.R.)). 1988. 6p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770137/JAW.

From Technical meeting of the Mineraloelwirtschaftwverband e.V.; Bonn, F.R. Germany (2 Mar 1988).

With their conservation legislation of the past years, whose execution will extend into the 1990's, the Federal Government has proved their determination and ability to put through their ecological targets. The German economy expects from them an equal amount of determination in the question of convincing the neighbouring countries of the principles of conservation and, with this, creating the prerequisites for a European pollution abatement community. (orig./HSCH).

5834 **(CWS/PYR—CW69-5/34E) Oil pollution of birds: an annotated bibliography.** Hooper, T.D.; Vermeer, K.; Szabo, I. (Canadian Wildlife Service, Delta, British Columbia. Pacific and Yukon Region). 1987. 187p. (MICROLOG—88-03021). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This bibliography consists of 606 citations, most of which are annotated, and provides a review of worldwide literature from 1922 to early 1986 on the effects of oil pollution on birds. It is arranged alphabetically by author, and includes and updates an earlier work on the same subject by Vermeer and Vermeer (1974).

5835 **(PACE—1987) Petroleum Association for Conservation of the Canadian Environment annual review, 1987.** (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1987. 32p. (In English and French). (CE—02049). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9.

The Petroleum Association for Conservation of the Canadian Environment (PACE) is a national, nonprofit, voluntary association formed by integrated Canadian oil companies to deal with environmental and health issues common to the manufacturing and distribution of petroleum products. PACE makes interventions before government bodies on public policy issues, and conducts research programs in its field of interest. Among these programs are: a study of gasoline vapor exposure at Canadian service stations; examining standards for underground storage tanks; investigating the environmental aspects of gasoline and diesel fuel; developing a perspective of risk management for the industry; monitoring, and developing regulations for, discharges from petroleum refineries; studies on the decommissionning of refineries and marketing facilities; establishing uniform national requirements regarding hazardous materials information for workplaces; providing a coperative government-industry response capability to major ship source pollution incidents; sponsoring experiments on hydrocarbons in groundwater; and developing guidelines for waste management. This review outlines the year's activities of PACE and describes its organizational structure.

5836 **(PACE—8709) Evaluation of small scale retardation tests for BTX in groundwater.** Gillham, R.W.; O'Hannesin, S.F. (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1987. 68p. (CE—02067). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $10.00 CAN.

This report provides the results from one part of a research study concerning benzene, toluene and xylene (BTX) contamination of groundwater. It attempts to critically evaluate small-scale methods for measuring the retardation caused by sorption of BTX as they move in groundwater, and to examine the range of retardation factors that could be expected for the soluble constituents of petroleum products in typical aquifer materials. Retardation factors are used to calculate the rate at which a contaminant moves relative to the groundwater velocity, and are therefore useful in evaluating the potential environmental impact of the dissolved constituents at a spill site. The results of this study indicate a range of retardation factors that could generally be expected for the soluble consituents of gasoline, and suggest the most practical means of measuring retardation from these materials. Retardation factors are generally calculated on the basis of the extent to which a contaminant is chemically partitioned between the solution and solid phases of a porous medium; such partitioning is represented by the distribution coefficient K. Various methods for predicting K in groundwater were examined; all methods showed similar trends, and were consistent with the theory of sorption of slightly soluble organic compounds in soil materials. Based largely on ease and low cost, the method involving correlations with the organic carbon content of the soil is the most suitable method for obtaining a first approximation of the K value. If more accurate estimations are required, it is recommended that the initial K estimates be supplemented with batch or column tests. Includes glossary. 31 refs., 14 figs., 6 tabs.

5837 **(PACE—8805) Fate of polynuclear aromatic hydrocarbons in refinery waste applied to soil.** (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1988. 156p. (CE—02064). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $10.00 CAN.

This report describes a study regarding the fate and persistence of polycyclic aromatic hydrocarbons (PAH) in soil that has been previously treated with refinery wastes. For the first part, a laboratory study, refinery waste additions were made to soil taken from a refinery landfarm and the concentrations of oil and grease and target PAHs were monitored with time. In the second part of the study, the concentrations of these same chemicals were monitored in soil and groundwater at three operating land farm sites. In the third, the fate of three of the PAH studied, benzo(a)pyrene, naphthalene and anthracene, was studied in detail using /sup 14/C-labelled compounds added to soil from a refinery landfarm site. The efficiency of conventional extraction, cleanup and analysis of samples proved to be extremely variable. In addition, loss of high molecular weight PAH from soil over a 200 day monitoring period was low and could not be quantified. It was observed that low molecular weight PAHs were readily lost from soil, as had been observed in the pure compound study, while high molecular weight PAH persisted. More precise information, obtained using /sup 14/C-labelled chemicals, confirmed that degradation of benzo(a)pyrene in soil occurred, although an 80 day acclimation period was required. Substantial degradation of benzo(a)pyrene in a field situation may not be observed in one field season under temperate, subhumid climatic conditions, as the effective length of the season may be insufficient for both acclimation and degradation. Of the 16 PAHs measured in this study, 8 were consistently found in landfarm soils with elevated PAH concentrations as compared to background levels. Of the groundwater samples that contained elevated PAH concentrations, anthracene and chrysene were most commonly identified. 16 refs., 112 figs., 26 tabs.

5838 **(PACE—8806) The behaviour of soluble petroleum product derived hydrocarbons in groundwater. Phase 3.** Berry-Spark, K.L.; Barker, J.F.; MacQuarrie, K.T. (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1988. 165p. (CE—02063). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $10.00 CAN.

Ths study contributes to the understanding of the processes controlling the migration or transport of selected organic compounds that dissolve in groundwater from petroleum products, particularly the monoaromatic hydrocarbons: benzene, toluene, and xylene isomers (BTX). The approach has been to inject both BTX-spiked and gasoline-contacted groundwater into a shallow, sand aquifer and to monitor the migration and persistence of these contaminants as they move in response to groundwater flow. BTX concentations were reduced from 1,740 μg/l to less than 2 μg/l within 434 days by biodegration and dispersive processes. Biodegradation was

shown to continue to reduce BTX concentrations below 1 μg/l by utilizing oxygen available within the groundwater. Biodegradation of BTX was limited by the availability of oxygen. Laboratory investigations indicate denitrifying bacteria can reduce nitrate to nitrogen gas while transforming BTX in oxygen-limited environments. Nitrate addition to existing gasoline-contaminated groundwater was evaluated as a remediation technique by comparing the BTX mass and displacement of centre of mass for nitrate-remediated and similar unremediated dissolved gasoline plumes. Nitrate addition enhanced the removal of toluene and m-xylene somewhat. A three-dimensional numerical model was used to examine the relative importance of site-specific, hydrogeological and biogeochemical parameters in controlling the persistence and mobility of BTX. Through a model sensitivity study, the results of the field research were generalized so to be applicable to other sites of interest. 93 refs., 50 figs., 26 tabs.

5839 **(SRC—E-902-6-D-67) Effects of oil and gas drilling wastes on crops and soils in Saskatchewan. A progress report.** Abouguendia, Z.M. (Saskatchewan Research Council, Saskatoon (Canada)). 1987. 3p. (CE—02057). Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $N/C.

This paper reports on progress in an evaluation of a number of case studies on drilling waste disposal sites in Saskatchewan, and on a series of growth room experiments on the effects of drilling waste disposal on Saskatchewan soils and crops. Field work and experiments pertaining to two of the four oil producing regions of the province. Processing and chemical analysis has been completed. Experiments have also been completed on materials from the other two regions.

5840 **(SRC—E-902-10-B-87) An evaluation of the effects of land application of oil and gas drilling wastes on soils and crops in the Kindersley and Estevan regions of Saskatchewan. A summary report.** Abouguendia, Z.M.; Godwin, R.C.; Baschak, L.A. (Saskatchewan Research Council, Saskatoon (Canada)). 1987. 71p. (CE—02058). Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $N/C.

The objectives of this study were to: assess the soil and crop conditions associated with the present drilling waste disposal practices in Saskatchewan; and evaluate the effects of application of drilling wastes on soils and crops under controlled growth room conditions. Only freshwater-based drilling fluid wastes were considered. The study consisted of germination, seedling emergence, and yield experiments in the growth room, and examining soil characteristics and plant responses at the field sites. Effects of drilling waste on soil characteristics were found to be influenced strongly by the rate of application and the chemical characteristics of the waste. In general, waste application resulted in elevated levels of some trace elements, but such levels were within the range considered normal for uncontaminated soils, except for Mo, whose concentrations were higher in waste-contaminated soil. Seed germination and seedling emergence did not appear to be sensitive to drilling waste application, using the crops, wastes, and application rates (up to 200 bbl/acre) of this study. Effects on wheat yield varied with waste characteristics and application rate; yield results are strongly related to the salinity level of the applied waste. Present off-lease disposal practices did not appear to cause change in soil salinity, but 50% of on-lease disposal sites showed an increase. Waste application had little effects on the available soil macronutrients. In most cases studied, present disposal practices had little effect on crop plant density or plant height; at sites where crop yields were reduced, increase in soil salinity appeared to be the main cause. 9 refs., 9 figs., 23 tabs.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 5824

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 5808

0230 Properties

5841 **(FRNC-TH—3262) Simple methods for calculation of liquid-vapor equilibria under pressure.** Rauzy, E. (Aix-Marseille-2 Univ., 13 - Marseille (France)). Jul 1982. 213p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755599/JAW.

Liquid-vapor equilibria are studied by a generalization of Soave and Peng-Robinson methods. These methods are tested with petroleum fluids: hydrocarbons, carbon dioxide, nitrogen and hydrogen sulfide. Estimations are correct for liquid-vapor equilibria but not for volumes. Also a volume correction is proposed for improving results.

5842 **(NIPER—160) Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Distillation and determination of routine chemical/physical properties: Topical report.** Green, J.B.; Grizzle, P.L.; Thomson, J.S.; Shay, J.Y.; Diehl, B.H.; Hornung, K.W.; Sanchez, V. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 91p. NTIS, PC A05/MF A01 - OSTI. Order Number DE88001235/JAW.

Part A discusses distillation of Cerro Negro heavy oil and general chemical/physical properties determined on each distillate and the residue. Based on GC-simulated distillation results, compounds boiling up to 700{degree}C atmospheric equivalent boiling point (AEBP) were distilled; nevertheless, total distillate yield represented only 55 weight percent of the whole crude. As revealed by comparative data on other crudes contained in the report, overall, chemical/physical properties of Cerro Negro crudes resemble those of tar sand bitumens and other geochemically related organic matter. Part B examines methodology for determining average molecular weights of Cerro Negro fractions and like materials. The theory and practice of vapor pressure osmometry (VPO) as applied to fossil fuels was critically evaluated through its application to Cerro Negro fractions and pure compounds, and by comparison of VPO results to those from other methods. Both solute-solute and solute-solvent intermolecular associations cause VPO data to be erroneously high, especially in cases where either the solutes and/or solvents are relatively polar. 79 refs., 24 figs., 6 tabs.

5843 **(NIPER—161) Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Preliminary separation and analysis of acid, base, saturate, and neutral-aromatic fractions.** Green, J.B.; Sturm, G.P. Jr.; Reynolds, J.W.; Thomson, J.S.; Yu, S.K-T.; Grigsby, R.D.; Tang, S.Y.; Shay, J.Y.; Hirsch, D.E.; Sanchez, V. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 129p. NTIS, PC A07/MF A01 - OSTI. Order Number DE88001236/JAW.

Cerro Negro 200-425{degree}, 425-550{degree}, and 550-700{degree}C distillates and >700{degree}C residue were separated into acid, base, and neutral concentrates using an improved nonaqueous ion exchange liquid chromatographic procedure. Neutral concentrates were further separated into neutral aromatic and saturated hydrocarbon fractions. A dual column, normal phase high performance liquid chromatographic method was developed for the saturate-aromatic separation. Mass and elemental balances are given for separations of all distillates and the residue. In addition, fractions from the 200-425{degree}C and 425-550{degree}C distillates were analyzed by high resolution mass spectrometry. The applicability of published separation approaches and methods to heavy oil analysis is critically reviewed; the bulk of the available methodolo-

gy developed for conventional petroleum and synfuels was found to be unproven or unsuitable for heavy oil analysis. Cerro Negro was found to contain 18.2 weight percent acids, 17.6 weight percent bases, 46.9 weight percent neutral aromatics, and 14.7 weight percent saturated hydrocarbons. Saturate fractions contained predominantly cycloparaffins, neutral-aromatics were largely comprised of aromatic hydrocarbons and sulfur compounds, bases were largely nitrogen-containing compounds, and acids were mostly oxygen-containing compounds and nitrogen compounds of pyrrolic type. 145 refs., 24 figs., 21 tabs.

5844 **(NIPER—325) Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Detailed separation and analysis of sulfur compounds.** Vogh, J.W.; Reynolds, J.W. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 58p. NTIS, PC A04/MF A01 - OSTI. Order Number DE88001242/JAW.

Neutral fractions of Cerro Negro crude oil have been analyzed for sulfur compound composition by several separation and identification methods. Sulfides were isolated by such procedures as adsorption and ligand exchange liquid chromatography and by sulfone derivative formation. New techniques in adsorption and ligand exchange chromatography were developed for Cerro Negro sulfide isolation, and these samples were analyzed by mass spectroscopy. The Cerro Negro 200--425{degree}C sulfide fraction contained alkyl sulfides and alkyl- or alkylaromatic disulfides as the most prominent components. The 425--550{degree}C fraction was more complex with many aromatic sulfide and disulfide compounds. Thiophenes were found to be abundant and complex in the neutral fractions. Conventional liquid chromatographic methods do not resolve thiophenes from aromatic hydrocarbons, and only newly developed ligand exchange chromatography procedures were found to produce useful thiophene concentrates. The fractions obtained were analyzed by mass spectroscopy and sulfur-sensitive gas chromatography. Thiophenes were found to span a range of molecular weight and ring number somewhat similar to the aromatic hydrocarbons. 36 refs., 8 figs., 17 tabs.

5845 **(NIPER—333) Thermodynamics of materials in the range of C_{10}-C_{16} data base description, uses, and future work recommendations.** Steele, W.V.; Archer, D.G.; Chirico, R.D.; Strube, M.M. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE88001243/JAW.

The literature was searched, and data on the thermodynamic properties of compounds in the carbon number range C_{10} to C_{16} were abstracted. The data were entered into two data bases assembled on an IBM PC/AT computer. The first data base (Property Data Base) contains the original thermodynamic property data abstracted from the literature. The second data base (Functions Data Base) contains the condensed-phase and ideal-gas thermodynamic functions for the 61 compounds where the available data permitted the derivation of properties. Section III of this report outlines the content of the data bases and updates the data gaps detailed in the previous Topical Report NAPC-PE-164-C (NIPER-243). Section IV, Applications of the Data Bases, details uses of the data bases in thermodynamic calculations related to the design of endothermic fuels, in fuel stability studies, and in the processing of alternate fuel sources. Section V outlines the conclusions reached in this research program, and Section VI provides recommendations for future work on the data bases (expansion of the data bases entailing broadening the carbon number range, theoretical calculations, and experimental measurements). 18 refs., 2 figs., 6 tabs.

5846 **(NIPER—334) Thermodynamics of materials in the range C_{10}--C_{16} data base reference manual.** Strube, M.M.; Archer, D.G.; Chirico, R.D.; Steele, W.V. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE88001244/JAW.

This document is intended to serve as a users guide for the Thermodynamic Properties and Thermodynamic Functions Data Base programs. Installation instructions are given for both data base programs. An overview of the data base structures and contents is then provided. A brief section outlining the special usage of the computer keyboard when accessing the data bases is also given. A guided tour through the data bases is provided with figures illustrating the various information screens and data files seen by the user at each stage. 16 figs., 2 tabs.

5847 **(NIPER—337) The thermodynamic properties of the five benzoquinolines: Topical report.** Steele, W.V.; Chirico, R.D.; Hossenlopp, I.A.; Nguyen, A. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). Oct 1988. Contract FC22-83FE60149. 59p. NTIS, PC A04/MF A01 - OSTI. Order Number DE88001240/JAW.

Measurements leading to the calculation of the ideal-gas thermodynamic properties for acridine, phenanthridine, and 7,8-benzoquinoline are reported. Thermochemical and thermophysical properties were determined by adiabatic heat-capacity calorimetry, comparative ebulliometry, inclined-piston, manometry, and combustion calorimetry. Comparisons with literature values are presented and discussed. Results were used to calculate entropies, enthalpies, and Gibbs energies of formation for the ideal-gas state at selected temperatures to 500 K. Group-contribution methods were used to estimate the ideal-gas entropy and enthalpy of formation at 400 K for the unstudied benzoquinolines: 5,6-benzoquinoline and 6,7-benzoquinoline. The relative stabilities of the compounds and comparisons with hydrocarbon analogues are discussed. A reaction scheme for the formation of the benzoquinolines is outlined and the relative concentrations of each isomer estimated for the reactions proceeding under thermodynamic control. 52 refs., 4 figs., 18 tabs.

0240 Storage

REFER ALSO TO CITATION(S) 5808

5848 **(PACE—8702) Guideline specification for the impressed current method of cathodic protection of underground petroleum storage tanks.** (Petroleum Association of Conservation of the Canadian Environment, Ottawa, Ontario). 1987. 27p. (CE—02068). Petroleum Association for Conservation of the Canadian Environment (PACE), 1202-275 Slater St., Ottawa, Ont., Canada K1P 5H9; $10.80 CAN.

These recommended specifications for the cathodic protection by the impressed current method of external surfaces of tanks storing flammable and combustible liquids are intended to be applied to existing underground tankage. The specifications cover general design requirements and specific requirements for rectifiers and electrodes; materials used in anodes, rectifier, cables, and related items; installation of the protection system, including preliminary testing; inspection and commissioning, including structure-to-soil measurements; and maintenance. 17 figs.

0250 Combustion

5849 **(BNL—41875) Production of soot by oil fired domestic heat equipment.** Butcher, T.A.; Wegrzyn, J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 16p. (CONF-880679—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003157/JAW.

From 81. annual meeting of Air Pollution Control Association; Dallas, TX, USA (1 Jun 1988).

Results are presented on recent studies at Brookhaven National Laboratory on the particulate emissions from domestic oil burners. This work has emphasized systems with very low exit gas temperatures (e.g., 105{degree}F) which are currently being introduced into the market-place. These condensing systems are of a particular concern because they have wet heat exchanger surfaces which are more sensitive to fouling by soot; and secondly, due to the low exhaust temperatures these systems are often not self drafting which can lead to a smoke problem following shutdown. Finally, there is another trend towards using these systems with sidewall venting, and for this application cleaner combustion is generally desired. Two methods were used in this study to examine these emissions. The direct filtering of gas samples was used to determine cycle average emissions while a multipass light extinction method

was used to examine startup and shutdown transients. It was found that startup and shutdown soot can contribute significantly to the total soot problem. A number of specific burner design features have been examined to minimize this soot production problem, and results of this work have shown that soot can be reduced in utilizing simple modifications of current designs. 10 refs., 13 figs.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 5806

0303 Drilling, Production, And Processing

5850 **(ESA-SP—280) Robot submarine for oil or gas-field development. The RIT robot on the eastern Frigg gas field.** Chereau, J. (Ateliers et Chantiers de Bretagne (ACB), 44 - Nantes (France)). (European Space Agency, 75 - Paris (France)). Mar 1988. 7p. (In French). (CONF-8711239—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755596/JAW.

From Colloquium on space and sea; Marseille, France (24 Nov 1987).

The East Frigg gas field, a part of the Frigg oil-field is developed using an underwater technology only. Equipments are modular and set without divers. The RIT (Running and Interconnecting Tool) is a subsea manipulator for fitting, interconnecting and maintenance of the modules. This robot demonstrates the feasibility of subsea work on offshore oil-fields without divers.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 5829, 6085

5851 (CERI—1988, pp 27) **US markets for imported natural gas.** Dreyfus, D.A. (Gas Research Inst., Washington, DC). 1988. Canadian Energy Research Institute, Calgary, Alberta. (CONF-8809206—; CE—02029).

From 7. CERI international oil and gas conference; Calgary, Canada (18 Sep 1988).

This presentation describes the nature of gas markets in the USA and the constraints on those markets for expansion. The role of imported gas within the range of energy sources is then discussed. Primary energy consumption, gas demand by sector, and potential environmental factors are outlined as influences on the gas market. Gas supply sources are presented along with forecasts of output from each. Canadian exports are forecast according to a number of scenarios, based on the assumption that Canadian policy will require assurance of protection for reasonably foreseeable domestic requirements. Canadian gas is expected to remain a significant supply option in the USA, and intense price competition is likely in the near term. 6 figs., 2 tabs.

5852 (CERI—1988, pp 5) **International gas trade developments. Review and outlook for natural gas in West European market.** Enseling, G. (Ruhrgas AG, West Germany). 1988. Canadian Energy Research Institute, Calgary, Alberta. (CONF-8809206—; CE—02029).

From 7. CERI international oil and gas conference; Calgary, Canada (18 Sep 1988).

The western European natural gas markets are shown in this presentation vary from country to country, being characterized as mature, young, or incipient markets. Overall gas consumption is used mainly in the residential, commercial, and industrial sectors, and demand is expected to increase, although not as much as previously expected, up to a relatively stable peak after the turn of the century. The supply side is diversified, with 51% of all supplies coming from domestic sources. Future supply forecasts show good availability from a variety of sources. Infrastructure and market conditions are also satisfactory.

5853 **(DOE/EIA—0130(88/09)) Natural gas monthly, September 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 1 Dec 1988. 149p. NTIS, PC A07/MF A01 - GPO - OSTI. Order Number DE89004073/JAW.

Dry gas production (wet marketed production minus extraction loss) during September 1988 was an estimated 1254 billion cubic feet, 0.6 percent below September 1987 dry gas production. Consumption of natural gas during September 1988 was an estimated 1148 billion cubic feet, 10.2 percent above the September 1987 level. The average wellhead price of natural gas in July 1988 was $1.49 per thousand cubic feet. In July 1987, the average price was $1.66 per thousand cubic feet. The average city-gate price for natural gas delivered to distribution service areas in August 1988 was $2.80 per thousand cubic feet, 3.1 percent below the August 1987 average. During the August 1988 billing cycle, residential consumers were billed an average of $6.82 per thousand cubic feet, commercial consumers $4.28 per thousand cubic feet, and industrial consumers $2.64 per thousand cubic feet. The residential average was down 0.3 percent, the commercial average was down 10.5 percent, and the industrial average down 3.6 percent compared to the August 1987 billing cycle. Electric utilities paid an average of $2.23 per thousand cubic feet for gas purchased during July 1988, 3.5 percent below the July 1987 average. At least 1448 billion cubic feet of surplus natural gas is estimated to be available during October 1988 to March 1989, a 9.2 percent drop from the October 1987 estimate. 6 figs., 35 tabs.

5854 **(GRI—88/0219) Competitive position of natural gas: Ferrous forging.** Minsker, B.S.; Hoerl, J.D.; Desai, T.M.; Salama, S.Y. (Gas Research Inst., Chicago, IL (USA); Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Jul 1988. 98p. NTIS, PC A05/MF A01 - OSTI. Order Number TI89003703/JAW.

The objective of this report is to identify the areas of opportunity and vulnerability for gas-based forging technologies and to develop a fundamental understanding of the competitive position of these technologies in various forging applications. The information and data collected from industrial users, equipment manufacturers, and industry experts are aimed at identifying: the size and energy consumption of the ferrous forging market; the characteristics of gas and competing technologies; the key factors influencing technology choices; the competitive position of natural gas technologies in the ferrous forging market; research and development concepts for improving the effectiveness of natural gas technology in ferrous forging applications. 26 refs., 9 figs., 17 tabs.

5855 **(GRI—9003702) Competitive position of natural gas: Ferrous forging.** (Gas Research Inst., Chicago, IL (USA)). Oct 1988. 8p. OSTI - Unlimited audience, publicly available. Gas Research Institute, 8600 West Bryn Mawr Avenue, Chicago, Illinois 60631. Order Number TI89003702/JAW.

Ferrous forging is an important industrial metal fabrication process. In 1985, production of ferrous forgings was approximately 1.3 million tons with a value of $3.1 billion. Ferrous forgings are facing increased competition from imports, and the future of the ferrous forging industry is largely dependent on the markets to which ferrous forgings are supplied. The largest market for ferrous metal forgings is the automotive industry, which is concentrated in the East North Central and Middle Atlantic regions. Earlier analysis indicated that the outlook for natural gas in the ferrous forging industry was mixed, with small workpiece forgings vulnerable to electric competition, and large workpiece forgings safe from electric technologies. In order to further quantify the current status of natural gas technologies in the ferrous forging industry and to identify areas where research and development projects could enhance the performance of these technologies, Gas Research Institute (GRI) contracted with Energy and Environmental Analysis, Inc., to assess the competitive position of natural gas in the ferrous forging industry. The results of this study indicate that electric heating technologies have and will continue to penetrate the small workpiece forging market, but that natural gas technologies are preferred in applications that require intermediate reheating or the ability to heat a variety of shapes and sizes in the same furnace.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 5839, 5840

0310 Legislation And Regulation

5856 **(MPUB—137/88) Interim ex parte order approving sales rates to be charged by Greater Winnipeg Gas Company effective Nov 1, 1988. Order 137/88.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 1988. 9p. (CE—02091). Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A Manitoba gas utility submitted an application to the provincial Utilities Board for approval to continue existing sales rates. In view of the fact that a new gas supply contract has not yet been executed, and the possible change in transportation tolls of TransCanada PipeLines, the Board approved an interim order, continuing the existing rate schedule pending a public hearing. Schedules of existing rates are appended for the various classes of service. 5 tabs.

5857 **(MPUB—138/88) Interim ex parte order approving sales rates to be charged by ICG Utilities (Manitoba) Ltd. effective Nov. 1, 1988. Order no. 138/88.** (Manitoba Public Utilities Board, Winnipeg (Canada)). 1988. 15p. (CE—02092). Manitoba Public Utilities Board, 405 Broadway Ave., Rm. 1146, Winnipeg, Man., Canada R3C 3L6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A Manitoba gas utility submitted an application to the provincial Utilities Board for approval to continue existing sales rates. The Board took into consideration the fact that a new gas supply contract was not yet executed, and that changes in transportation tolls of TransCanada PipeLines and Minell Pipeline were expected. Since it is thus possible that any new rates will have to be changed, possibly within the next 3 months, it was not felt appropriate to approve a new rate structure at this time. Rather, the existing rate structure was approved to be continued on an interim ex parte basis, pending a public hearing. Schedules are appended giving the interim rates for the various classes of service. 11 tabs.

5858 **(OEB—8802) Decision with reasons in the matter of the Ontario Energy Board Act and in the matter of an application by I.C.G. Utilities (Ontario) Ltd. for rates.** (Ontario Energy Board, Toronto (Canada)). 1988. 112p. (CE—02043). Ontario Energy Board, 14 Carlton St., 9th Floor, Toronto, Ont., Canada M5B 1J2; $N/C.

An application was made before the Ontario Energy Board by ICG Utilities, an Ontario gas utility, for approval or fixing of rates and other charges for the sale and transportation of gas. A hearing was conducted to determine the rate base, the rate of return allowed, the total cost of service, any revenue deficiency and the recovery of that deficiency through rate changes. In setting rates, the Board considered forecasts of economic activity in Ontario, and thereby established the prime interest rate and the inflation rate to be used for rate setting purposes. In considering utility income, the Board examined issues related to gas sales forecasts, profitability of certain marketing programs, shared service expenses and certain other expenses. In determining the test year rate base, the applicant's average investment in property, plant and equipment, plus an allowance for working capital. In examining the applicant's capital structure and rate of return, investment and financial risks were considered, and the rates of return on each element of the capital structure were addressed. The revenue deficiency for the test year was calculated; this deficiency is to be recovered through the increased rates. Includes glossary. 1 fig., 5 tabs.

5859 **(NPA—BT31-2/1989-III-31) Northern Pipeline Agency Canada 1988-89 estimates, Part 3.** (Northern Pipeline Agency, Ottawa, Ontario (Canada)). 1988. 38p. (In English and French). (MICROLOG—88-02496). Northern Pipeline Agency (Canada), 200 Kent St., Stn. 210, Ottawa, Ont., Canada K1A 0E6; $3.00 OTHER COUNTRIES $3.60 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Northern Pipeline Agency was created to oversee the planning and construction of the Canadian portion of the Alaska Highway Gas Pipeline Project by the Foothills Group of companies. The Agency was designed to function as a single regulatory authority to streamline and expedite the approval process with respect to the many federal acts that apply to pipeline construction. To date, the southern portion of the pipeline and the facilities required to transport Canadian gas to markets in the USA have been completed; future goals of the Agency are to maintain the Agency, as required by legislation, with a minimum staff, pending resumption of pipeline construction, and to facilitate any pre-construction activities that may be necessary. This report presents information about the Agency's programs and financial data on its income and expenses. It is noted that all costs are recovered either from Foothills Pipe Lines (Yukon) or from others, and are not borne by the taxpayer. 2 figs., 7 tabs.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 5858

0330 Properties

REFER ALSO TO CITATION(S) 5841

04 OIL SHALES AND TAR SANDS

REFER ALSO TO CITATION(S) 5806

5860 **(AFIA—7401) The Alberta oil sands story.** (Alberta Dept. of Federal and Intergovernmental Affairs, Edmonton (Canada)). 1974. 50p. (CE—02089). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report serves as a detailed introduction to the Alberta oil sands and their development. It includes a description of the oil sands deposits, an outline of crude bitumen recovery and upgrading processes, the role of Alberta Energy Company in oil sands development, environmental aspects, manpower requirements for oil sands development, research needs, and further oil sands projects. Presently proven recoverable reserves in the oil sands amount to 26.5 billion bbl of synthetic crude. Production from the Syncrude plant (125,000 bbl/d capacity) is expected to begin in 1977, followed by a Shell Canada operation around 1980. The provincial government will participate in the oil sand industry through its joint venture participation in Syncrude and its 50% share in Alberta Energy Company; the latter company participates in related aspects of the Syncrude project, such as pipelines. The result of Alberta's participation in the industry will mean that, directly or indirectly, the province will realize 60% of the total profits. The job creation potential of oil sands projects is estimated to be extensive, with a direct and indirect work force supported by oil sands activities possibly reaching 180,000 persons by the year 2000. Research needs have been identified, particularly in the area of in-situ thermal recovery technology, and the creation of the Alberta Oil Sands Technology and Research Authority has been authorized in order to meet these needs. Although current reserves are sufficient to support 20-30 synthetic crude plants, a number of factors will limit expansion of the industry. 8 figs., 5 tabs.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 6088

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 5778

05 NUCLEAR FUELS

0501 Reserves, Exploration, And Mining

5861 **(IAEA-TECDOC—468) Contractual arrangements for uranium exploration and mining.** (International Atomic Energy Agency, Vienna (Austria)). Jul 1988. 145p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704484/JAW.

Uranium exploration in WOCA, stabilized since 1985 at a level of annual expenditures of US $120-150 million. About half of this amount is funded by mining companies based in the uranium consumer countries such as the Federal Republic of Germany, France, the Republic of Korea, Japan, United Kingdom etc. and expended outside their home countries, mainly in Australia, Canada and USA, but also in a number of African countries. As WOCA's uranium production is concentrated in a few countries, in 1986, Australia, Canada, South Africa and USA had a combined share of nearly 70% of the total, a stronger diversification of uranium supplies may be desirable in the future. This expected trend may result in the planning or uranium exploration projects by international uranium companies in countries in Africa, Asia and South America. To provide information which can be helpful for both parties in the negotiations of cooperation agreement is the scope of this document. It contains a brief introductory part including an overview of the development of the different forms of international cooperation, a case history provided by Zambia, a report listing the essential subjects to be included in an uranium agreement as well as an example of a structure of contractual arrangements. This part is followed by an extensive annex with three "no-names-no numbers" contract texts, which were concluded in the later part of the 1970s and beginning of the 1980s.

5862 (IAEA-TECDOC—468, pp 7-12) **Contractual forms of international co-operation in the uranium mining industry.** Mueller Kahle, E. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Fuel Cycle). Jul 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704484/JAW.

In Contractual arrangements for uranium exploration and mining.

The uranium raw material activities, including exploration, production and marketing are carried out in an international frame. Significant uranium consumers such as Belgium, the Federal Republic of Germany, France, the Republic of Korea, Japan, Sweden, Switzerland, etc. are importing variable portions of their reactor related uranium requirements. In the search for an assurance of supply, uranium exploration was started in foreign countries, which have a good uranium potential associated with an appropriate political and economical climate, and led in a number of cases to uranium discoveries and the construction of mines and mills, partly or wholly owned by foreign mining companies. This international involvement creates the need for a sound contractual base protecting the interests of both parties, in most cases the host country and the foreign mining company, the "investor". In other cases, between 2 mining companies, one national and one foreign. The different forms of co-operation under special consideration of the joint venture are outlined.

5863 (IAEA-TECDOC—468, pp 13-18) **Uranium agreements. Conditions considered fundamental for such agreements: Zambia, a case study.** Money, N.J. (Prescribed Minerals and Materials Commission, Lusaka (Zambia)). Jul 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704484/JAW.

In Contractual arrangements for uranium exploration and mining.

In order to secure effective development of the uranium resources of foreign lands there is need for the Developed Nations to conclude equitable agreements with host governments, usually Developing Nations of the world. In the case of Developed Nations it is the desire for commodity for sale to secure the much needed foreign exchange. In both cases the need for a mutually profitable and acceptable agreement is necessary the terms depending on market and urgency of each party to secure supplies. Several factors are of major importance like the potential for the required mineral, the political environment especially peace and order inducing substantial foreign investment to explore and eventually exploit the mineral, the legislative framework and fiscal laws consistent for sustained investment. The terms and conditions of an agreement concluded should be such to give confidence, credibility and indeed an equitable standing to contracting parties to enable stable and fruitful development. The features of the Zambian contractual agreements are considered a model worth adopting, as proof of its success has been established.

5864 (IAEA-TECDOC—468, pp 27-29) **Structuring of an agreement.** Bourrel, J.; Fuchs, H.; Money, N.J. (Compagnie Generale des Matieres Nucleaires (COGEMA), 78 - Velizy, Villacoublay (France); Urangesellschaft m.b.H. und Co. K.G., Frankfurt am Main (Germany, F.R.); Prescribed Minerals and Materials Commission, Lusaka (Zambia)). Jul 1988. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704484/JAW.

In Contractual arrangements for uranium exploration and mining.

5865 **(INIS-XN—126) Uranium resources, production and demand.** (Nuclear Energy Agency, 75 - Paris (France)). 1988. 211p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88704562/JAW.

Nuclear power-generating capacity will continue to expand, albeit at a slower pace than during the past fifteen years. This expansion must be matched by an adequately increasing supply of uranium. This report compares uranium supply and demand data in free market countries with the nuclear industry's natural uranium requirements up to the year 2000. It also reviews the status of uranium exploration, resources and production in 46 countries.

0504 Feed Processing

REFER ALSO TO CITATION(S) 6234

0505 Uranium Enrichment

5866 **(POEF-T—3484) Performance characteristics of the Cooper PC-9 centrifugal compressor.** Foster, R.E.; Neely, R.F. (Martin Marietta Energy Systems, Inc., Piketon, OH (USA)). 30 Jun 1988. Contract AC05-76OR00001. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003804/JAW.

Mathematical performance modeling of the PC-9 centrifugal compressor has been completed. Performance characteristics curves have never been obtained for them in test loops with the same degree of accuracy as for the uprated axial compressors and, consequently, computer modeling of the top cascade and purge cascades has been very difficult and of limited value. This compressor modeling work has been carried out in an attempt to generate data which would more accurately define the compressor's performance and would permit more accurate cascade modeling. A computer code, COMPAL, was used to mathematically model the PC-9 performance with variations in gas composition, flow ratios, pressure ratios, speed and temperature. The results of this effort, in the form of graphs, with information about the compressor and the code, are the subject of this report. Compressor characteristic curves are featured. 13 figs.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 6162, 6185, 6186, 6213, 6214, 6811, 6999, 7000

5867 (CONF-880911—23) The effect of carbon crystal structure on treat reactor physics calculations. Swanson, R.W.; Harrison, L.J. (Argonne National Lab., Idaho Falls, ID (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003625/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The Transient Reactor Test Facility (TREAT) at Argonne National Laboratory-West (ANL-W) is fueled with urania in a graphite and carbon mixture. This fuel was fabricated from a mixture of graphite flour, thermax (a thermatomic carbon produced by "cracking" natural gas), coal-tar resin and U_3O_8. During the fabrication process, the fuel was baked to dissociate the resin, but the high temperature necessary to graphitize the carbon in the thermax and in the resin was avoided. Therefore, the carbon crystal structure is a complex mixture of graphite particles in a nongraphitized elemental carbon matrix. Results of calculations using macroscopic carbon cross sections obtained by mixing bound-kernel graphite cross sections for the graphitized carbon and free-gas carbon cross sections for the remainder of the carbon and calculations using only bound-kernel graphite cross sections are compared to experimental data. It is shown that the use of the hybridized cross sections which reflect the allotropic mixture of the carbon in the TREAT fuel results in a significant improvement in the accuracy of calculated neutronics parameters for the TREAT reactor. 6 refs., 2 figs., 3 tabs.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 5902

5868 (CEA-CONF—9476) From the reactor to waste disposal: the back-end of the nuclear fuel cycle. Madic, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). May 1988. 19p. (CONF-880514—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755610/JAW.

From Workshop on biological assessment of occupational exposure to actinides; Versailles, France (30 May 1988).

The oxide fuels discharged from LWRs represent the bulk of spent fuels to be managed. For a 1 GWe LWR about 27 tonnes of spent fuels are discharged each year. This makes the total amount of spent LWR oxide fuels discharged worldwide in 1986 close to 4500 tonnes. For France, 750 tonnes of spent oxide fuels were discharged in 1986. Three alternatives are available: final disposal, interim storage, and reprocessing. This paper focusses on reprocessing option. The reprocessing is based on the PUREX Process comprising: 1/ fuel dissolution in nitric acid after shearing the fuel assembly, 2/ separation of uranium and plutonium by TBP extraction. After purification, the major actinides can be reused. A wide gap exists today between the amount of fuels discharged from LWRs and the reprocessing capacities. France has the broadest experience in reprocessing commercial LWR oxide fuels, with more than 2200 tonnes already reprocessed at La Hague. This plant will have a total reprocessing capacity of 1600 t/y in the early nineties. The minor actinides present in the spent fuels, neptunium, americium and curium, will be packaged with the fission products in glass blocks. For a 1 Gwe LWR, about 3.5 m/sup 3/ of vitrified HAW and 83 m/sup 3/ of MAW will be produced each year. All the wastes produced during reprocessing operations with an alpha activity $>$ 0.1 Ci/t will be stored in deep geological repositories in the future. Studies are underway to determine the ideal geological sites. The solution to this problem is undoubtedly a key to the progress in the production of nuclear electricity.

5869 (CEA-CONF—9563) Simulation of uranium/plutonium splitting in a pulsed column in the purex process. Baron, P.; Duhamet, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 3p. (CONF-8807136—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755612/JAW.

From ISEC '88: international solvent extraction conference; Moscow, USSR (18 Jul 1988).

The reductive plutonium stripping operations carried out in the Purex process, such as uranium/plutonium splitting, are sometimes difficult to get under control. When these operations are performed in pulsed columns, added to the complexity of the chemical reactions involved, are the specific features of this type of contactor, whose performance is governed by a set of equally complex factors. The perfect control of this process, both in the design phase and in the operating phase, requires the availability of a simulation tool incorporating the various aspects of the operation. The French Commissariat a l'Energie Atomique accordingly set up a research programme aiming to develop a mathematical model simulating the behaviour of the different species concerned in unsteady state conditions.

5870 (CEA-CONF—9565) Solvent extraction of dibutylphosphate bearing alkaline wastes from purex process. Pasquiou, J.Y.; Germain, M.; Chesne, A.; Pareau, D.; Chevalier, S. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Dept. de Genie Radioactif; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (FR). Inst de Recherche Technologique et de Developpement Industriel (IRDI); Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (FR)). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 4p. (CONF-8807136—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755613/JAW.

From ISEC '88: international solvent extraction conference; Moscow, USSR (18 Jul 1988).

In the Purex process tributylphosphate undergoes chemical and radiolytic attack leading to the formation of acidic degradation products, mainly dibutylphosphate (DBP) and to a lesser extent monobutylphosphate (MBP). These alkylphosphoric compounds are extractants and may also give insoluble complexes with several cations of fission products. Thus their elimination from the organic phase by alkaline scrubbing of the solvent is necessary. The alkaline solution is generally made of carbonate, in order to keep uranium and plutonium, which can be present in small quantities, under a soluble form. The destination of this aqueous solution is usually the high or the medium activity wastes. Recycling actinide values from these effluent solutions in the process is to be considered to lower alpha-activity in the wastes. In this paper is studied the tri-iso-octylamine for extracting the disturbing organophosphorous compounds from neutral or alkaline solutions where they are under an anionic form. The actinides will stay in these aqueous solutions which can be concentrated and recycled without any risk of precipitation.

5871 (CEA-CONF—9567) Malonamides as new extractants. Cuillerdier, C.; Hubert, H.; Hoel, P.; Musikas, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 5p. (CONF-8807136—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755614/JAW.

From ISEC '88: international solvent extraction conference; Moscow, USSR (18 Jul 1988).

Diamides of carboxylic acids could be an alternative to the mixture (carbamoylphosphonate, TBP) which is used nowadays in the TRUEX process to extract actinides from radioactive wastes. These solvents are economically interesting because they are easy to prepare and to purify. They are completely incinerable and don't create new wastes. First investigations have consisted in selecting the number of carbons between the two functional groups; it appeared that malonamides offer the best possibilities. As they act as chelating agents towards metallic cations steric effects are very important. It has been shown that a dissymetry between substituents has a favourable influence on extractive properties. Mechanisms of

extraction have been investigated with dimethyl-dioctyl malonamide (noted as L) in t-butylbenzene. Extraction of metals peculiarly important in the nuclear wastes have been undertaken: U VI, Pu IV, VI and Np V are well extracted. They can be back extracted without chemical transformations (valence changes or complexation). Zr IV follows uranium and plutonium and must be separated by complexation in the aqueous phase.

5872 **(CEA-CONF—9568) New actinides extractants for the nuclear fuels reprocessing.** Musikas, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). 1988. 5p. (CONF-8807136—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755615/JAW.

From ISEC '88: international solvent extraction conference; Moscow, USSR (18 Jul 1988).

Other extractants of actinides than TBP will be surveyed and evaluation of their potentiality to replace TBP will be given. As wastes minimization appears one of the goal of the research and development, it is necessary to limit the amounts of wastes of nuclear fuels reprocessing. The nature of the organic solvents plays an important role. The complete extractant incinerability and regeneration process avoiding the use of saline solutions must be searched for. First we will consider the N,N-dialkylamides of carboxylic acids as alternative to TBP in PUREX type processes. The basic chemistry of actinide extraction by several N,N dialkylamides will be discussed as well as their hydrolytic or radiolytic behavior. Results of counter current separations will be presented and the up-to-date evaluation of N,N-dialkylamides as industrial extractant will be given. The second part will be devoted to the problem of extracting trivalent actinides from acidic aqueous solutions. We will compare the behavior of N,N'-tetraalkyl-malonamides and N,N' pentaalkyles propanediamides to the organophosphorus bidentate extractants described in the literature. Original data for the actinides and fission products chemistry of extraction will be presented. The practical interest of diamides will be discussed through the up to date knowledge of their radiolytic or hydrolytic behavior. Results of counter-current chemical separations will be reported and the amount of research and development still necessary to make diamides industrial useful extractant will be evaluated.

5873 **(DP-MS—88-111) Automation of the second uranium cycle in the H-modified U-235 separation process.** Feldmeyer, E.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1988. Contract AC09-76SR00001. 31p. (CONF-8810174—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89000500/JAW.

From Plutonium/uranium recovery operations conference; Idaho Falls, ID, USA (4 Oct 1988).

The Savannah River Plant, operated by E. I. du Pont de Nemours & Co. for the United States Department of Energy, has automated the Second Uranium Cycle of the H-modified U-235 separation process through the installation of a Fisher ProVOX Distributed Control System. This automation replaced the existing panel board operation with a microprocessor based control system that includes a comprehensive set of algorithms and auxiliaries with full control and monitoring capabilities. The system is capable of both continuous (regulatory) and sequential (batch) operation controls. The installation allows the automation of several procedures or sequences that operators performed manually prior to installation. These sequences include Nuclear Safety Control monitoring, startup and shutdown of the separation cycle, batch evaporation of the feed streams, and vessel transfers with volumetric receipt checking. Also, several software interlocks were installed to prevent tank overflows, Operation Safety Requirement limits from being exceeded during the evaporation phase, and to minimize the credibility of a nuclear accident.

5874 **(LA—11383-M) Receipts Assay Facility Instrument Control Function users manual.** Barlich, G.L. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 55p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003440/JAW.

This manual describes user interfaces provided with the Receipts Assay Facility portion of the Instrument Control Function system for the New Special Recovery Facility at the Savannah River Plant. Interactions are broken down into operator, supervisory, and managerial functions. A list of system messages and a list of acronyms are provided.

5875 **(WINCO—1059) Development and testing of a rotary disc pulser for pulse column application.** Olson, A.L. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Oct 1988. Contract AC07-84ID12435. 136p. NTIS, PC A07/MF A01 - OSTI. Order Number DE89004007/JAW.

Air pulse column contactors are a favored method of conducting radiochemical liquid-liquid separations processes. They have no moving parts and are easily operated from behind thick shielding. A ruggedly constructed more reliable air pulsing device was developed and its operation mathematically characterized in this study. Additionally, a correlation for the column perforated nozzle plate discharge coefficient was developed. Rigorous mass, momentum, and energy balances were solved using a computer software code entitled "Advanced Continuous Simulation Language." Experimental data from a 2-inch diameter glass column equipped with the prototypical air pulser showed that column pulse amplitudes could be predicted within 10% for the conditions studied and within 5% for normal column operating conditions. 17 refs., 45 figs., 15 tabs.

0509 Transport And Storage

5876 **(INIS-mf—11853) Bavarian Land Parliament. Committee for regional development and environmental affairs. 33. meeting, Thursday 21 January 1988. Report of Bavarian State Secretary of Regional Development and Environmental Affairs, Mr. Alfred Dick, on management of wastes from Bavarian nuclear facilities, with special emphasis on irregularities discovered in the Hanau Transnuklear GmbH, and their effects on the situation in Bavaria - with discussions.** (Bayerischer Landtag, Muenchen (Germany, F.R.). Ausschuss fuer Landesentwicklung). 21 Jan 1988. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756102/JAW.

Summary record, not authorized by speaker.

The State Secretary delivered a detailed report on the nuclear waste management in Bavaria and put special emphasis on the situation created by the Transnuklear GmbH skandal. He stated that there are no hazards to personnel or the population induced by the irregularities disclosed in the firm, but nevertheless public acceptance of nuclear power has been shaken, and inquiries into the matter have to lead to proper punishment of those responsible, as is done in the field of conventional waste management. The call for complete shut-down of nuclear facilities, however, is stated to be the wrong answer, as it would not finish up with the waste management problem since there is considerable radioactive waste produced by medical establishments, research institutes, and industry. (orig./HSCH).

5877 **(INIS-XN—127) Radioactive materials and emergencies at sea.** Shaw, K.B. (Nuclear Energy Agency, 75 - Paris (France)). 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704563/JAW.

Recent events have heightened awareness of the problems raised by accidents at sea involving radioactive materials. The NEA Committee on Radiation Protection and Public Health (CRPPH) noted that, while the transport of radioactive materials at sea is governed by extensive international regulations, deficiencies remained, particularly concerning mechanisms for early accident reporting and the development of generic safety assessments and accident analysises for various kinds of sea transport. As a contribution towards improving international guidance in this field, the NEA appointed a consultant to review the current status of activities carried out by the principal international organizations concerned with the transport of radioactive materials (the IAEA, IMO and the CEC), to identify the various areas where additional work is required and to suggest appropriate improvements. Only the radiation protection aspects of sea transport have been considered here. After having examined the consultant report, the CRPPH felt that its wide distribution to national regulatory authorities in OECD countries would serve a useful purpose. The report is published under

the responsibility of the Secretary-General of the OECD and does not commit Member Governments or the Organization.

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REFER ALSO TO CITATION(S) 5868, 6216, 6232, 6424, 6425, 6426, 7021, 7163

5878 **(CEA-CONF—9570) Mixed and chelated waste test programs with bitumen solidification.** Simpson, S.I.; Morris, M.; Vidal, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 8p. (CONF-880903—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755616/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, United States (11 Sep 1988).

This paper presents the results of bitumen solidification tests on mixed wastes and chelated wastes. The French Atomic Energy Commission (CEA) performed demonstration tests on radioactive wastes contaminated with chelating agents for Associated Technologies, Inc. (ATI). The chelated wastes were produced and concentrated by Commonwealth Edison Co. as a result of reactor decontamination at Dresden Nuclear Station, Unit 1. Law Engineering in Charlotte, N. C. produced samples and performed tests on simulated heavy metal laden radioactive waste (mixed) to demonstrate the quality of the bituminous product. The simulation is intended to represent waste produced at Oak Ridge National Labs operated by Martin-Marietta.

5879 **(CEA-CONF—9571) Alpha waste incineration prototype incinerator and industrial project.** Caramelle, D.; Lannaud, J.; Martinez, B.; Meyere, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Service de Physique Theorique; CEA Centre d'Etudes de Valduc, 21 - Is-sur-Tille (FR); CEA Centre de Marcoule, 30 - Bagnols-sur-Ceze (FR). Dept. de Genie Radioactif). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1988. 15p. (CONF-880526—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755617/JAW.

From International conference on incineration of hazardous, radioactive, and mixed wastes; San Francisco, CA, United States (3 May 1988).

To meet our requirements with respect to the processing of solid alpha wastes, a pilot cold incinerator has been used for R and D. This unit has a capacity of 5 kg/hr. The main objectives assigned to this incineration process are: a good reduction factor, controlled combustion, ash composition compatible with plutonium recovery, limited secondary solid and fluid wastes, releases within the nuclear and chemical standards, and in strict observance of the confinement and criticality safety rules. After describing the process we will discuss the major results of the incineration test campaigns with representative solid wastes (50 % PVC). We will then give a description of an industrial project with a capacity of 7 kg/hr, followed by a cost estimate.

5880 **(CEA-CONF—9584) Nuclear application of rare gases in polymers.** Lecomte, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 18p. (In French). (CONF-8806285—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755619/JAW.

From 31. colloquium of metallurgy at Saclay on gas in materials; Saclay, France (20 Jun 1988).

This paper deals with the mechanisms of transport of noble gases through polymeric membranes, and their application to the separation of radioactive fission products.

5881 **(CNEA-NT—21/87) High-level radioactive waste fixation in sintered vitreous matrix.** Russo, D.O.; Messi de Bernasconi, N.; Audero, M.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1987. 9p. (In Spanish). (CNEA-REPO—25). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704940/JAW.

The safe storage of high-level wastes from fuel elements reprocessing includes, as a first step, the fixation of the same in materials having a good resistance to the leaching in aqueous medium, such as borosilicate glass. As an alternative to the usual method of the molten glasses, a procedure for the sintering of a powdered glass and waste mixture at lower temperatures (600-700 deg C) has been developed, which minimizes the volatilization of active compounds during the process. Two glasses matrices of different composition and characteristics were used, to which the simulated wastes were added in the ratio of a 10% in weight of oxides. Two sintering techniques were employed 1: cold pressing and further sintering; 2: hot pressing and sintering under pressure. The densities were measured, the microstructure of the samples was analyzed and leaching essays were made in distilled water. The pellet's microstructure was observed by means of optical microscopy, by reflection in polished samples and by transparency in thin slices. The presence of crystalline compounds was analyzed by means of x rays and electron microprobe. The results have shown the convenience to continue with hot pressing essays, because a denser product with a higher resistance to the leaching is thus obtained. (M.E.L.).

5882 **(CNEA-NT—26/87) Immobilization of high-level wastes into sintered glass: 1. Hot pressing process.** Russo, D.O.; Messi de Bernasconi, N.; Audero, M.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1987. 11p. (In Spanish). (CNEA-REPO—30). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704941/JAW.

In order to immobilize the high-level radioactive wastes from fuel elements reprocessing, borosilicate glass was adopted. Sintering experiments are described with the variety VG 98/12 (SiO/sub 2/, TiO/sub 2/, Al/sub 2/O/sub 3/, B/sub 2/O/sub 3/, MgO, CaO and Na/sub 2/O) (which does not present devitrification problems) mixed with simulated calcinated wastes. The hot pressing line (sintering under pressure) was explored in two variants 1: In can; 2: In graphite matrix with sintered pellet extraction. With scanning electron microscopy it is observed that the simulated wastes do not disolve in the vitreous matrix, but they remain dispersed in the same. The results obtained point out that the leaching velocities are independent from the density and from the matrix type employed, as well as from the fact that the wastes do no dissolve in the matrix. (M.E.L.).

5883 **(CNEA-NT—28/87) Prediction of the radionuclide migration in the rocky environment. Part 1.** Ventura, M.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1987. 81p. (In Spanish). (CNEA-REPO—32). NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88704943/JAW.

A model for the prediction of the migration of radionuclides in a granitic rock was developed. Different numerial techniques associated with the resolution of the differential equations representing the problem were analysed. Verification results of the developed methodologies are presented.

5884 **(CNEA-NT—29/87) Prediction of the radionuclide migration in the rocky environment. Part 2. Bidimensional case.** Ventura, M.A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Gerencia de Proteccion Radiologica y Seguridad). 1987. 40p. (In Spanish). (CNEA-REPO—33). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704944/JAW.

An extension to a bidimensional form, from the model for the prediction of the migration of radionuclides in a granitic rock developed in Part I /1/, was made. The differential equations wich represent the physical problem are resolved by the explicit method

of calculus. This model is applicated to examples of the bibliographie, and a verification study of the method was made.

5885 **(CONF-8811101—2) Transportation training: Focusing on movement of hazardous substances and wastes.** Jones, E.; Moreland, W.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03 - OSTI. Order Number DE89002980/JAW.

From 12. annual TRADE conference; San Francisco, CA, USA (7 Nov 1988).

Over the past 25 years extensive federal legislation involving the handling and transport of hazardous materials/waste has been passed that has resulted in numerous overlapping regulations administered and enforced by different federal agencies. The handling and transport of hazardous materials/waste involves a significant number of workers who are subject to a varying degree of risk should an accident occur during handling or transport. Effective transportation training can help workers address these risks and mitigate them, and at the same time enable ORNL to comply with the federal regulations concerning the transport of hazardous materials/waste. This presentation will outline how the Environmental and Health Protection Division's Technical Resources and Training Program at the Oak Ridge National Laboratory, working with transportation and waste disposal personnel, are developing and implementing a comprehensive transportation safety training program to meet the needs of our workers while satisfying appropriate federal regulations. 8 refs., 5 figs., 3 tabs.

5886 **(CONF-8811104—1) Bioprocessing applications in the management of nuclear and chemical wastes.** Genung, R.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003368/JAW.

From Meeting on bioprocessing research for energy applications; Alexandria, VA, USA (2 Nov 1988).

The projected requirements for waste management and environmental restoration activities within the United States will probably cost tens of billions of dollars annually during the next two decades. Expenditures of this magnitude clearly have the potential to affect the international competitiveness of many US industries and the continued operation of many federal facilities. It is argued that the costs of implementing current technology will be too high unless the standards and schedules for compliance are relaxed. Since this is socially unacceptable, efforts to improve the efficiency of existing technologies and to develop new technologies should be pursued. A sizable research, development, and demonstration effort can be easily justified if the potential for reducing costs can be shown. Bioprocessing systems for the treatment of nuclear and chemically hazardous wastes offer such promise. 11 refs.

5887 **(CORR—86-0399) The PATHRAE-HAZ performance assessment code for the land disposal of hazardous chemical wastes.** Rogers, V.C.; Merrell, G.B.; Bollenbacher, M.K. (Savannah River Lab., Aiken, SC (USA); Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)). Aug 1986. Contract AC09-76SR00001. 126p. (RAE—8511-29). NTIS, PC A07 - OSTI. Order Number DE89003453/JAW.

In addition to the capability of analyzing the transport of radioactive contaminants, recent extensions of the PATHRAE model have permitted the analysis of disposed or stored hazardous chemical wastes as well as radioactive wastes. The versions of the code used for radioactive and hazardous chemical waste calculations are referred to as PATHRAE-RAD and PATHRAE-HAZ, respectively. This report contains the documentation necessary for the use of the PATHRAE-HAZ code. It is intended for use by persons familiar with a pathway approach similar to that used in the PATHRAE-EPA and PRESTO -EPA family of codes. A summary of the equations and calculational methods used in PATHRAE-HAZ is presented in Chapter 2. Chapter 3 contains detailed input instructions which will allow the user to construct the necessary data files to fully utilize the capabilities of PATHRAE-HAZ. A description of the program options is also given. 7 refs., 8 figs., 8 tabs.

5888 **(CORR—86-0400) The PATHRAE-RAD performance assessment code for the land disposal of radioactive wastes.** Merrell, G.B.; Rogers, V.C.; Bollenbacher, M.K. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)). Aug 1986. Contract AC09-76SR00001. 137p. NTIS, PC A07 - OSTI. Order Number DE89003500/JAW.

In addition to the capability of analyzing the transport of radioactive contaminants, recent extensions of the PATHRAE model have permitted the analysis of disposed or stored hazardous chemical wastes as well as radioactive wastes at the Savannah River Plant. The versions of the code used for radioactive and hazardous chemical waste calculations are referred to as PATHRAE-RAD and PATHRAE-HAZ. This report contains the documentation necessary for the use of the PATHRAE-RAD code. It is intended for use by persons familiar with a pathway approach similar to that used in the PRESTO-EPA and PATHRAE-EPA family of codes. A summary of the equations and calculational methods used in PATHRAE-RAD is presented in Chapter 2. Chapter 3 contains detailed input instructions which will allow the user to construct the necessary data files to fully utilize the capabilities of PATHRAE-RAD. A description of the program options is also given. 8 figs., 7 tabs.

5889 **(DOE/NE/44139—38) West Valley demonstration project: Implementation of the kerosene mitigation plan.** Blickwedehl, R.R.; Goodman, J.; Valenti, P.J. (West Valley Nuclear Services Co., Inc., West Valley, NY (USA)). May 1987. Contract AC07-81NE44139. 51p. NTIS, PC A04 - OSTI. Order Number DE88015385/JAW.

An aggressive program was implemented to mitigate the migration of radioactive kerosene believed to have originated from the West Valley NRC-Licensed Disposal Area (NDA) disposal trenches designated as SH-10 and SH-11 (Special Holes 10 and 11). This report provides a historical background of the events leading to the migration problem, the results of a detailed investigation to determine the location and source of the kerosene migration, the remediation plan to mitigate the migration, and the actions taken to successfully stabilize the kerosene. 7 refs., 19 figs., 1 tab.

5890 **(DOE/NV/10327—40) Initial studies of tritium migration at the Greater Confinement Disposal Test (GCDT) facility: Preliminary report, February 1987--July 1988.** Swanson, D.E.; Greger, P.D.; Hunter, R.B.; Fujii, R.M.; Romney, E.M.; Schulz, R.K. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). Oct 1988. Contract AC08-84NV10327. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003838/JAW.

Investigations of tritium migration at the Greater Confinement Disposal Test (GCDT) began three years after waste emplacement. In February 1987, the GCDT was turned over to the direction of Dr. R.K. Schulz for tritium migration studies, after the completion of the in-situ tracer gas experiment. Two things were studied: the migration of tritium oxide in all directions around the waste and tritium oxide transport to the atmosphere from the central borehole. Work to date indicates that the migration towards the surface is predominate while the horizontal migration appears negligible. Additionally, about 10/sup {minus}10/ of the buried tritium is being released to the atmosphere per day; an extremely small fraction of the total tritium disposed. As is, indications are that the GCDT is a very good disposal facility. Modifications of the backfill and capping procedure during closure are expected to raise the performance even higher. 4 refs., 15 figs., 7 tabs.

5891 **(DOE/NV/10576—T1-Vol.1) Yucca Mountain Project Site Atlas: Volume 1: Draft.** (Science Applications International Corp., Las Vegas, NV (USA)). Oct 1988. Contract AC08-87NV10576. 599p. NTIS, PC A25/MF A01 - OSTI. Order Number DE89003704/JAW.

The Nevada Nuclear Waste Storage Investigations (NNWSI) Project Site Atlas is a reference document of field activities which have been, or are being, conducted by the US Department of Energy (DOE) to support investigations of Yucca Mountain as a potential site for an underground repository for high-level radioactive waste. These investigations, as well as future investigations, will yield geologic, geophysical, geochemical, geomechanical,

hydrologic, volcanic, seismic, and environmental data necessary to characterize Yucca Mountain and its regional setting. This chapter summarizes the background of the NNWSI Project and the objective, scope, structure, and preparation of the Site Atlas. Chapter 2 describes in more detail the bibliography and map portfolio portions of the Atlas, which are presented in Chapter 4 and Volume 2, respectively. Chapter 3 describes how to use the Atlas. The objective of the Site Atlas is to create a management tool for the DOE Waste Management Project Office (WMPO) that will allow the WMPO to compile and disseminate information regarding the location of NNWSI Project field investigations, and document the permits acquired and the environmental, archaeological, and socioeconomic surveys conducted to support those investigations. The information contained in the Atlas will serve as a historical reference of site investigation field activities. A companion document to the Atlas is the NNWSI Project Surface Based Investigations Plan (SBIP).

5892 **(DOE/NV/10576—T1-Vol.2) Nevada Nuclear Waste Storage Investigations atlas of field activities, Yucca Mountain, Nye County, Nevada: Volume II.** (Holmes and Narver, Inc., Las Vegas, NV (USA). Energy Support Div.). [1988]. Contract AC08-87NV10576. 444p. NTIS, PC A19/MF A01 - OSTI. Order Number DE89003705/JAW.

This document contains only engineering drawings that support text material in Volume I. (TEM)

5893 **(DOE/WIPP—86-011) Demonstration plan for the remote-handled transuranic waste mock retrieval demonstration.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Jan 1987. Contract AC04-86AL31950. 34p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003555/JAW.

This plan addresses the Remote-Handled Transuranic (RH TRU) Waste Mock Retrieval Demonstration that will be conducted at the Waste Isolation Pilot Plant (WIPP). It defines the scope of the Mock Demonstration and organizational units responsible for the conduct of this demonstration, and it provides the criteria by which success of the demonstration will be measured. Successful performance of this Mock Demonstration will fulfill a WIPP design criterion as well as one of the milestones identified in the Agreement for Consultation and Cooperation with the State of New Mexico.

5894 **(DOE/WIPP—86-014) Initial computer modeling of WIPP [Waste Isolation Pilot Plant] underground ventilation system, September 1985--March 1986.** Sethi, S. (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Nov 1986. Contract AC04-86AL31950. 118p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89003556/JAW.

Provision of a good ventilation system has been and continues to be a major priority here of those responsible for its design, management, and operation. As an ongoing effort in this direction, development of computer simulated models for the system was initiated in September, 1985. It was decided to utilize Dravo's 'MINEVENT' computer program for this purpose. Accordingly, initial computer models of the mine's ventilation system have been developed for various modes of operation. Specifically, they include: Simulation of the current ventilation system, and Simulation of the designed ventilation system for modes: mine construction mode/shift, waste storage mode/shift, and air reversal mode. 5 figs.

5895 **(DOE/WIPP—87-001) Demonstration plan and demonstration procedure for the contact-handled (CH) transuranic (TRU) waste mock retrieval demonstration.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). 28 Jul 1987. Contract AC04-86AL31950. 57p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003552/JAW.

This plan addresses the Contact-Handled Transuranic (CH TRU) Waste Mock Retrieval Demonstration that will be conducted at the Waste Isolation Pilot Plant (WIPP). It defines: the scope of the CH TRU Mock Retrieval Demonstration; organizational units responsible for the conduct of this demonstration; and the criteria by which success of the demonstration will be measured. Successful performance of this CH TRU Mock Retrieval Demonstration will fulfill a WIPP design criterion as well as one of the milestones identified in the Agreement for Consultation and Cooperation with the State of New Mexico. This plan addresses in-room retrieval operations only. Demonstration of the complete waste handling process from receipt through waste emplacement in the underground storage area will be completed as part of the separate TRU Preoperational Checkout. Retrievability of waste emplaced in WIPP is required throughout the Operations Demonstration period. This period spans the time from initial waste emplacement through that point when a declaration is made regarding whether or not WIPP should become a permanent disposal facility. 4 refs., 5 figs.

5896 **(DOE/WIPP—88-002) Annual site environmental monitoring report for the Waste Isolation Pilot Plant, Calendar year 1985.** Reith, C.; Prince, K.; Fischer, T.; Rodriguez, A.; Uhland, D.; Winstanley, D. (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Apr 1986. Contract AC04-86AL31950. 88p. NTIS, PC A05 - OSTI. Order Number DE89003554/JAW.

This is the first Annual Site Environmental Monitoring Report for the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico. The WIPP project is operated by the US Department of Energy (DOE) for the purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes generated by the defense activities of the U.S. Government. The report provides a comprehensive description of environmental activities at WIPP during Calendar Year 1985, including: a description of the WIPP project and its mission; a description of the local environment, including demographics; a summary of environmental program information, including an update on the status of environmental permits and compliance activities; a presentation of the findings of the Radiological Baseline Program (RBP), which is a program to characterize radionuclide activities in the environment around the WIPP site; and a summary of findings of the Ecological Monitoring Program (EMP), which examines non-radiological impacts of WIPP construction on the surrounding ecosystem. The WIPP facility is under construction, and will not receive radioactive wastes before October 1988. Therefore, this report describes the status of preoperational (as opposed to operational) environmental activities. 29 refs., 17 figs., 22 tabs.

5897 **(DOE/WIPP—88-023) Particle penetration through CAM-sampler aerosol transport lines.** Anand, N.K.; McFarland, A.R. (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Apr 1988. Contract AC04-86AL31950. 45p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003551/JAW.

A numerical model is developed to predict particle deposition in aerosol sampling lines due to turbulent diffusion and gravitational settling. Input parameters to the model are particle diameter, air flow rate, tube length, and the inside tube diameter--the latter will be referred to as tube diameter for brevity. The flow rate of air in the sampling lines at WIPP site is in the range of 1--2.5 cfm. Additionally, models developed by others are set up for determining for penetration of aerosol through tube bends and the aspiration of air into the transport tubes. In general, the results of the calculations show aerosol transmission to the CAM samplers to be most significantly impacted by inlet operational characteristics and by the presence of horizontal tube runs and tube bends. 6 refs., 30 figs., 3 tabs.

5898 **(DP-MS—88-47) Performance assessments of closure cap alternatives at the Savannah River Plant.** Cook, J.R. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 12p. (CONF-880839—10). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002887/JAW.

From Annual DOE low-level waste management conference; Denver, CO, USA (30 Aug 1988).

Several large waste sites at the Savannah River Plant will be closed within the next few years, including two sets of seepage basins and a mixed waste disposal facility. Technical support for the closure caps for these facilities included water balance calculations for a series of cap designs using the Hydrologic Evaluation of Landfill Performance (HELP) code together with time dependant dose calculations using the Rogers and Associates PATHRAE

code. The results of the HELP code showed that a cap constructed with clay having a hydraulic conductivity of 10^{-7} cm/sec and good drainage will be 97.6% effective in preventing infiltration through the cap. PATHRAE results show that with the reduced infiltration all exposures will be at acceptable levels after a 100-year institutional control period. 9 refs., 1 fig., 5 tabs.

5899 **(DPST—87-574) Pump and agitation in the CPC: Capacity and attainment.** Voogd, J.A. (Savannah River Lab., Aiken, SC (USA)). 30 Jul 1987. Contract AC09-76SR00001. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003833/JAW.

During the TNX SRAT/SME Batch No. 3 transfer to the Melter Feed Tank (7B86), the transfer pump lost its prime. This occurred while the SRAT agitator was on high speed (130 rpm) with 3200 gallons of slurry remaining in the tank. The transfer pump failure pump failure during high speed agitation lead to an investigation of the phenomena and a DWPF operating impact evaluation. This report summarizes the activities and the results that constituted Technology Issue 4.1, Pumping and Agitation in the CPC (Chemical Processing Cell). 4 refs., 6 figs., 4 tabs.

5900 **(EUR—11162) Denitration and chemical precipitation of medium level liquid wastes and conditioning of high level wastes from low level liquid wastes by a roll dryer and subsequent vitrification.** Halaszovich, S.; Dix, S.; Harms, R. (Kernforschungsanlage Juelich G.m.b.H. (DE). Inst. fuer Chemische Technologie der Nuklearen Entsorgung). (Commission of the European Communities, Luxembourg). 1987. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755644/JAW.

Medium level liquid waste (MAW) from the reprocessing need after being fixed in cement an additional shielding to meet required radiation limits for handling and transportation. Normally this shielding consists of concrete and its weight and volume is several times higher than that of the waste product itself. By means of cesium separation using nickel-potassium-hexacyanoferrate and after few years of interim storage waiting for the decay of Ruthenium and Antimony the activities will be reduced below permissible values. (13 MBq/l in waste solution for Cs, 28 MBq/l for Sb and 34 MBq/l for Ru). Below these limits there is no need for additional shielding after cementation in a 400 l drum. Experimental results show, that Caesium can be precipitated and separated effectively not only in laboratory but also in a larger scale under hot cell conditions. The process investigated in this work has been developed from the FIPS process for vitrification of highly radioactive fission product solutions. It consists of: denitration, precipitation, sludge separation, drying and melting.

5901 **(EUR—11499) HADES demonstration and pilot project Progress report 1985-86.** Bruyn, D.de; Meynendonckx, P.; Neerdael, B.; Noynaert, L.; Voet, M.; Volckaert, G.; Bonne, A. (Centre d'Etude de l'Energie Nucleaire, Mol (BE)). (Commission of the European Communities, Luxembourg). 1988. 54p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755463/JAW.

This report deals with the activities of SCK/CEN and its subcontractors performed during the years 1986-87 in the framework of the HADES demonstration and pilot project, which is carried out in the geological Boom clay formation underlying the nuclear research establishment at Mol. This demonstration and pilot project is sponsored by the Commission of the European Communities under contract number F11W-004 B (B) in the framework of Part B of the CEC programme on radioactive waste management and disposal. The actions undertaken and reported here deal essentially with design and engineering activities in preparation for the construction of a test drift and of a mine-by-test directly related to this construction test and of a combined irradiation/heating test to be performed later on in this test drift. A time schedule for the various tests planned to be made in the test drift has also been worked out taking into account time and spatial dependencies.

5902 **(INIS-mf—11849) Tritium-enrichment via CECE-process with high-temperature steam electrolysis (HOT ELLY). Final report.** Erdle, E.; Keil, W. (Dornier-System G.m.b.H., Friedrichshafen (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1988. 160p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756101/JAW.

Reprocessing of nuclear fuel elements produces tritiated water which has to be disposed of for final storage. The amount of waste can be significantly reduced by tritium-enrichment. Besides distillation the CECE-process (Combined Electrolysis Catalytic Exchange) can be applied to that. The objective of the study was the investigation of questions concerning process engineering and safety aspects related to high-temperature steam electrolysis ('HOT ELLY') with respect to the potential for its application within the radioactive system of the CECE-process instead of a conventional electrolyzer. A process engineering concept for the integration of a high temperature electrolyzer into the CECE-process was designed. A comparative assessment with respect to the application of a conventional electrolysis-process revealed the usage of a high temperature electrolyzer to be attractive. Main advantages are significant reduction of the radioactive inventory and the avoiding of secondary waste. Prohibitive safety problems are not seen. (orig.) With 39 refs., 18 tabs., 38 figs.

5903 **(INIS-XN—145) In situ research and investigations in OECD countries.** (Nuclear Energy Agency, 75 - Paris (France)). 1988. 126p. NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS. Order Number DE88704962/JAW.

This report explains why deep geological disposal is the most favoured option for the disposal of high level waste and spent fuel, as well as some alpha bearing wastes. It also gives an overview of the main aim and elements of in-situ research and investigation activities in OECD countries, as well as of initiatives taken at an international level.

5904 **(ORNL/TM—10759) Characterization of clay minerals and organic matter in shales: Application to high-level nuclear waste isolation.** Gueven, N.; Landis, C.R.; Jacobs, G.K. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 65p. NTIS, PC A04/MF A01. Order Number DE89003369/JAW.

The objective of the Sedimentary Rock Program at the Oak Ridge National Laboratory is to conduct investigations to assess the potential for shale to serve as a host medium for the isolation of high-level nuclear wastes. The emphasis on shale is a result of screening major sedimentary rock types (shale, sandstone, carbonate , anhydrite, and chalk) for a variety of attributes that affect the performance of repositories. The retardation of radionuclides was recognized as one of the potentially favorable features of shale. Because shale contains both clay minerals and organic matter, phases that may provide significant sorption of radioelement, the characterization of these phases is essential. In addition, the organic matter in shale has been identified as a critical area for study because of its potential to play either a favorable (reductant) or deleterious (organic ligands) role in the performance of a repository sited in shale. 36 refs., 36 figs., 10 tabs.

5905 **(ORNL/TM—10932) Organic geochemistry: Effects of organic components of shales on adsorption: Progress report.** Ho, P.C. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004257/JAW.

The Sedimentary Rock Program at the Oak Ridge National Laboratory is investigating shale to determine its potential suitability as a host rock for the disposal of high-level radioactive wastes (HLW). The selected shales are Upper Dowelltown, Pierre, Green River Formation, and two Conasauga (Nolichucky and Pumpkin Valley) Shales, which represent mineralogical and compositional extremes of shales in the United States. According to mineralogical studies, the first three shales contain 5 to 13 wt % of organic matter, and the two Conasauga Shales only contain trace amounts (2 wt %) of organic matter. Soxhlet extraction with chloroform

and a mixture of chloroform and methanol can remove 0.07 to 5.9 wt % of the total organic matter from these shales. Preliminary analysis if these organic extracts reveals the existence of organic carboxylic acids and hydrocarbons in these samples. Adsorption of elements such as Cs(I), Sr(II) and Tc(VII) on the organic-extracted Upper Dowelltown, Pierre, green River Formation and Pumpkin Valley Shales in synthetic groundwaters (simulating groundwaters in the Conasauga Shales) and in 0.03-M $NaHCO_3$ solution indicates interaction between each of the three elements and the organic-extractable bitumen. 28 refs., 8 figs., 10 tabs.

5906 **(ORNL/TM—10933) Effects of experimental parameters on the sorption of cesium, strontium, and uranium from saline groundwaters onto shales: Progress report.** Meyer, R.E.; Arnold, W.D.; Case, F.I.; O'Kelley, G.D. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004258/JAW.

This report concerns an extension of the first series of experiments on the sorption properties of shales and their clay mineral components reported earlier. Studies on the sorption of cesium and strontium were carried out on samples of Chattanooga (Upper Dowelltown), Pierre, Green River Formation, Nolichucky, and Pumpkin Valley Shales that had been heated to 120{degree}C in a 0.1-mol/L NaCl solution for periods up to several months and on samples of the same shales which had been heated to 250{degree}C in air for six months, to simulate limiting scenarios in a HLW repository. To investigate the kinetics of the sorption process in shale/groundwater systems, strontium sorption experiments were done on unheated Pierre, Green River Formation, Nolichucky, and Pumpkin Valley Shales in a diluted, saline groundwater and in 0.03-mol/L $NaHCO_3$, for periods of 0.25 to 28 days. Cesium sorption kinetics tests were performed on the same shales in a concentrated brine for the same time periods. The effect of the water/rock (W/R) ratio on sorption for the same combinations of unheated shales, nuclides, and groundwaters used in the kinetics experiments was investigated for a range of W/R ratios of 3 to 20 mL/g. Because of the complexity of the shale/groundwater interaction, a series of tests was conducted on the effects of contact time and W/R ratio on the pH of a 0.03-mol/L $NaHCO_3$ simulated groundwater in contact with shales. 8 refs., 12 figs., 15 tabs.

5907 **(PNL—6716) Interim characterization report for the 300 Area process trenches.** Schalla, R.; Wallace, R.W.; Aaberg, R.L.; Airhart, S.P.; Bates, D.J.; Carlile, J.V.M.; Cline, C.S.; Dennison, D.I.; Freshley, M.D.; Heller, P.R. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 743p. NTIS, PC A99/MF A01 - OSTI. Order Number DE89003706/JAW.

This document contains information on the results of the Hazardous Waste Ground-Water Monitoring Compliance Program characterization studies of wastes disposed of in the 300 Area process trenches. The characterization of the 300 Area process trenches has been conducted as part of an effort initiated in June 1985, when a facility-specific monitoring program was implemented. The characterization effort is part of a regulatory ground-water monitoring compliance program for hazardous chemicals on the Hanford Site. The characterization work described in this document represents an expanded ground-water monitoring compliance effort, and incorporates or refers to previous studies useful in characterizing the 300 Area. This document is primarily a compendium of technical information on the 300 Area; therefore, data interpretations are limited to the most obvious conclusions. Final conclusions will not be presented until the analysis of data is completed in September 1989. 48 refs., 25 figs., 4 tabs.

5908 **(PNL—6723) West Valley glass product qualification durability studies, FY 1987--1988: Effects of composition, redox state, thermal history, and groundwater.** Reimus, M.A.H.; Piepel, G.F.; Mellinger, G.B.; Bunnell, L.R. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 130p. NTIS, PC A07/MF A01 - OSTI. Order Number DE89003724/JAW.

The product qualification subtask of the West Valley Support Task (WVST) at Pacific Northwest Laboratory (PNL) provides support for the waste form qualification efforts at West Valley Nuclear Services Co. Testing is being conducted to determine waste form chemical durability in support of these efforts. The effects of composition, ferrous/ferric ratio (redox state), thermal history, and groundwater are being investigated. Glasses were tested using modified Materials Characterization Center (MCC) -3 and MCC-1 test methods. Results obtained in fiscal years (FY) 1987 and 1988 are presented here. 13 refs., 27 figs., 36 tabs.

5909 **(SAAS—362) In-situ solidification of liquid radioactive waste.** Ebel, K.; Mitreiter, C.; Radke, S.; Schulze, H. (VE Kombinat Kernkraftwerke, Greifswald (German Democratic Republic)). (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. 20p. (In German). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704973/JAW.

A practical method for in-situ solidification of liquid radwaste in subsurface caverns by means of hydraulic binding agents is described with main emphasis being given to the demands on the properties of the components, their feeding technology, the methods of process control as well as radiation safety considerations for this solidification method which, at the same time, represents an advantageous way of backfilling caverns.

5910 **(SAAS-Mitt—87-03) Guides concerning disposal of nonradioactive wastes originating from uses of atomic energy.** (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1987. 4p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704672/JAW.

Based on the corresponding legal regulations of the German Democratic Republic guidance is given for the disposal of non- and low-level radioactive wastes arising from peaceful uses of atomic energy. Prior to final disposal it has to be carefully checked, whether the wastes are reprocessable. Radiation protection requirements to be met by the enterprises where wastes originate, and requirements for disposal procedures according to the Environmental Policy Act are pointed out.

5911 **(SAND—88-2023C) Summary of WIPP materials interface interactions test data on metals interactions and leachate brine analyses.** Molecke, M.A.; Sorensen, N.R.; Krumhansl, J.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 19p. (CONF-8810189—2). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003134/JAW.

From Commission of European Communities workshop on testing of high level waste glass under repository conditions; Cadarache, France (17 Oct 1988).

Several series of in situ, high-level waste form leaching and waste form-engineered barrier materials interactions test have been in progress at the Waste Isolation Pilot Plant (WIPP) facility since July 22, 1986. This multi-national effort, the WIPP Materials Interface Interactions Tests (MIIT), involves the underground testing of about 1900 (nonradioactive) waste form, metal, and geologic samples in the bedded salt at the WIPP, near Carlsbad, New Mexico, in the USA. Posttest analyses of metal and brine leachate samples retrieved after 0.5, 1, and 2 years of heated testing are in progress now; available data and interpretations thereof are summarized in this paper. Titanium, Inconel, and copper samples had very little degradation. Stainless steel 304L samples suffered from significant stress corrosion cracking and pitting. Both mild steel A216/WCA and lead samples corroded severely, adding many ions and particulates to solution. Observed trends in brine leachate compositions for many test assemblies are very similar to those measured for control-blank tests and are, therefore, difficult to interpret at this time. Measured pH values are also difficult to interpret. The leachate analyses and associated geochemical evaluations are intended to supplement glass waste form surface studies, and to provide analysts and modelers with supporting information for their interpretations. 9 refs., 1 tab.

5912 **(SKB-TR—88-11) Groundwater numerical modelling of the Fjaellveden study site - evaluation of parameter variations. A HYDROCOIN study - level 3, case 5A.** Larsson, N.A.; Markstroem, A. (Swedish Geological Co., Uppsala; Kemakta Konsult AB, Stockholm (Sweden)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Kemakta Konsult AB, Stockholm (Sweden)). Oct 1987. 68p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756091/JAW.

The sensitivity/uncertainty of the hydraulic conductivity distribution in crystalline rocks is considered at the Fjaellveden study site - a site included in the Swedish site selection programme for final storage of spent nuclear fuel. A three-dimensional FEM-model assuming steady-state flow with constant fluid properties under saturated conditions is used. The bedrock of the site is divided into three hydraulic units; rock mass, local and regional fracture zones. The data set of hydraulic conductivity of each unit has been treated statistically in various ways, reflecting different aspects of the physical conditions of the site. A total of nine cases have been prepared, all based on 214 data points.

5913 **(SKB-TR—88-16) Swedish Hard Rock Laboratory first evaluation of preinvestigations 1986-87 and target area characterization.** Gustafson, G.; Stanfors, R.; Wikberg, P. (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Jun 1988. 109p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756093/JAW.

SKB plans to site an underground research laboratory in the Simpevarp area. A regional survey started in 1986 and an extensive programme for geology, geohydrology and hydrochemistry was carried through. This report gives an evaluation of all available data gathered from the start of the project up to the drilling of core boreholes in some target areas in the autumn of 1987. A descriptive geological-tectonic model on a regional scale is presented that is intended to constitute a basis for the hydrogeological modelling work. Preliminary rock mass descriptions are also presented on a more detailed scale for some minor parts of the area. It is recommended that the island Aespoe is the principal target area for the continued work on the Swedish Hard Rock Laboratory.

5914 **(UCRL—53841) Verification and validation studies of the addition of Pitzer's equations to the EQ3/6 brine model.** Jackson, K.J. (Lawrence Livermore National Lab., CA (USA)). 20 Jul 1988. Contract W-7405-ENG-48. 67p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003708/JAW.

Recent modifications to the EQ3/6 geochemical modeling software package provide a new option which can be used to compute the activity of water and the activity coefficients of solute species in both brines and dilute solutions. This option is based on equations proposed by Pitzer (1973) which allow approximation of mean molal activity coefficients ({gamma}{sub {plus←minus}}) and osmotic coefficients ({phi}) up to high ionic strengths, and which, together with an appropriate ion-splitting convention, also afford calculation of individual ion activity coefficients ({gamma}{sub i}) in brines. Values of {gamma}{sub {plus←minus}} and {phi} generated by EQ3/6 for binary and compositionally higher order systems compare favorably with their experimental and hand-calculated counterparts. The addition of Pitzer's equations to EQ3/6 as an optional method for calculating activity coefficients represents a significant improvement over the previous versions of the codes, which were limited to the use of a simple extended form of the Debye-Hueckel equation (the B-dot equation of Helgeson, 1969). Test runs using EQ3/6 to calculate solubility limits in simple binary and ternary systems (NaCl-H{sub 2}O, KCl-H{sub 2}O, and KCl-NaCl-H{sub 2}O) confirm the capability of the codes to accurately predict geochemical equilibria between brines and evaporite minerals in the sample systems. The test runs were sufficiently comprehensive to verify the accuracy of the calculational procedures and to partially validate the capability of the codes to dependably model the geochemical behavior of aqueous electrolyte solutions having ionic strengths as high as {approximately}6 m, subject to the availability of the requisite thermodynamic data and activity coefficient parameters. 24 refs., 6 figs., 8 tabs.

5915 **(WHC-EP—0107) Measurement of the oxidation of spent fuel between 140{degree} and 225{degree}C by thermogravimetric analysis.** Woodley, R.E.; Einziger, R.E.; Buchanan, H.C. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 84p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89003016/JAW.

A series of PWR spent fuel samples from Turkey Point Unit 3 have been oxidized at temperatures between 140{degree} and 225{degree}C in air atmospheres with dew points between 14.5{degree} and {minus}70{degree}C, using a thermogravimetric analysis system (TGA). Tests lasted between 400 and 2100 hours. At the conclusion of a test, the atmosphere was sampled to determine the release of fission gas during testing, and the fuel samples were analyzed for microstructural changes. It appears that the mechanism for oxidation of spent fuel to U{sub 3}O{sub 7} takes place in two steps that occur somewhat simultaneously. Oxygen migrates along the grain boundaries, which are oxidized and enlarged. The grains oxidize by the inward progression of a layer of U{sub 4}O{sub 9} saturated with oxygen. A simplified model of the mechanism, which considers oxygen diffusion through the product layer as the rate-controlling step, yields an activation energy of 27 {plus←minus} 4 kcal/mol. Moisture, between dew points of {minus}70{degree} to +14.5{degree}C, i.e., water vapor partial pressures varying over four orders of magnitude, had no significant effect on the oxidation rate. 34 refs., 12 figs., 6 tabs.

5916 **(WHC-SA—0417) Tools and techniques used in the US Department of Energy decommissioning programs.** Miller, R.L. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 12p. (CONF-8810233—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003165/JAW.

From U.S. DOE annual planning conference; Germantown, MD, USA (18 Oct 1988).

The United States Department of Energy (DOE) sponsors the largest surplus nuclear facility decommissioning program in the United States. This program includes over 300 retired nuclear facilities that have been earmarked for decontamination and decommissioning. Since the program's inception in 1978, the Defense Decontamination and Decommissioning (D and D) Program has successfully decontaminated and decommissioned 43 facilities. As a result, the implementation and completion of these projects have demonstrated a number of decommissioning tools and techniques that have subsequently become the backbone of the DOE's ongoing decommissioning program. Among the decommissioning methods employed, many decontamination, demolition, cutting, and waste management tools have been used throughout the DOE's decommissioning program, and new techniques have been developed for use with these tools. This article discusses the advantages of using various tools and techniques, including the cost effectiveness of using certain methods.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 5885, 5886, 5887, 5888, 5891, 5892, 5893, 5894, 5895, 5896, 5897, 5898, 5904, 5905, 5906, 5907, 5911, 5914, 5916

0540 Health And Safety

REFER ALSO TO CITATION(S) 5885

5917 **(DOE/ER/60577—T1) Generation and mobility of radon in soil: Annual technical progress report.** Rose, A.W. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences). [1988]. Contract FG02-87ER60577. 20p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003042/JAW.

This research program is designed to evaluate the extent and nature of uranium and radium depletion and/or enrichment in soil horizons, as a function of climate and other factors affecting soil character; evaluate the relation of radon emanation coefficient to soil type, soil properties, soil-forming factors and radon levels in soil gas; and evaluate the relation of fragipans, soil mixture and soil

permeability to radon concentration and radon flux in soil profiles. During the first year of this project, five soil profiles in central Pennsylvania (3 over limestone/dolomite, 2 over sandstone) were sampled and described and a variety of analysis, including radium and uranium, conducted on the samples, as summarized on table 1. The radon content of soil gas through the profiles was measured at approximately two week intervals throughout the year, so that we now have essentially a year of data. Cores were collected from four soil profiles at a variety of depths and the permeability, diffusion coefficient and emanation coefficient are being measured over a range of moisture contents and temperatures. Selective chemical extractions were used to determine the form of radium and uranium in the soil. 7 refs., 10 figs., 1 tab.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 6386

5918 **(WHC-SA—0242) ITAC: An insider threat assessment computer program.** Eggers, R.F.; Giese, E.W. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 6p. (CONF-880631—56). NTIS, PC A02/MF A01 - OSTI. Order Number DE89001161/JAW.

From 29. annual meeting of the Institute of Nuclear Materials Management; Las Vegas, NV, United States (26 Jun 1988).

The insider threat assessment computer program, ITAC, is used to evaluate the vulnerability of nuclear material processing facilities to theft of special nuclear material by one or more authorized insider adversaries. The program includes two main parts: one is used to determine the timeliness of nuclear material accounting tests for loss of special nuclear material, and the other determines pathway aggregate detection probabilities for physical protection systems and material control procedures that could detect the theft. Useful features of ITAC include its ability to (1) evaluate and quantify the timeliness of material accounting tests, (2) analyze branching systems of physical pathways and adversary strategies, (3) analyze trickle or abrupt theft situations for combinations of insiders, (4) accept input probabilities and times in the form of ranges rather than discrete points, and (5) simulate input data using Monte Carlo methods to produce statistically distributed aggregate delay times and detection probabilities. The ITAC program was developed by the Security Applications Center of Westinghouse Hanford Company and Boeing Computer Services, Richland, WA. 1 ref., 3 figs., 4 tabs.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 5861, 5862, 5863, 5864, 5877

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0702 Radiation Sources

5919 **(CONF-880546—39) Neutron sources: Present practice and future potential.** Cierjacks, S.; Smith, A.B. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003951/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

The present capability and future potential of accelerator-based monoenergetic and white neutron sources are outlined in the context of fundamental and applied neutron-nuclear research. The neutron energy range extends from thermal to 500 MeV, and the time domain from steady-state to pico-second pulsed sources. Accelerator technology is summarized, including the production of intense light-ion, heavy-ion and electron beams. Target capabilities are discussed with attention to neutron-producing efficiency and power-handling capabilities. The status of underlying neutron-producing reactions is summarized. The present and future use of neutron sources in: fundamental neutron-nuclear research, nuclear data acquisition, materials damage studies, engineering tests, and biomedical applications are discussed. Emphasis is given to current status, near-term advances well within current technology, and to long-range projections. 90 refs., 4 figs.

5920 (INIS-SU—61/A, pp 16-21) **Radiation sedimentation testing of dispersed material granulometric composition.** Danilin, Yu.A.; Kostyuchenko, A.V.; Krejndlin, I.I.; Matveev, L.V.; Ryzhikov, V.K. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).

In Radiation technique. Scientific-technical collection.

A technique for determination of dispersed material granulometric composition using the gamma-adsorption sedimentary method is considered. A mathematical model of the radiation sedimentometer is constructed. The block diagram of the device, algorithm of its operation and computer codes are described. The device allows to determine relative mass distribution of particles of metallic powders by classes with dimensions from 2 to 100 μm and density from 8.3 to 16.6 g/cm/sup 3/ during measuring time not more than 20 minutes. 5 refs.; 3 figs.

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 6088

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 5938, 5940, 6223

5921 **(DOE/ER/13580—T1) Mechanisms and controlling characteristics of the catalytic oxidation of methane: Technical progress report, December 15, 1987--December 14, 1988.** Klier, K.; Simmons, G.W.; Herman, R.G. (Lehigh Univ., Bethlehem, PA (USA)). 1988. Contract FG02-86ER13580. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003542/JAW.

The objective of this research is the development of the fundamental knowledge of the catalytic function of transition metals (Pd and Rh) in conversion of methane to oxygenates and C_2^+ hydrocarbons, which will lead to new catalysts for these processes. Since oxygen chemisorbed on palladium effects the oxidation of methane under mild conditions, all of the oxygen phases that formed on Pd(100) for oxygen pressures of 1.3 x 10^{-9} kPa to 1.3 x 10^{-7} kPa and temperatures of 300K to 600K were characterized. Oxygen was found to adsorb dissociatively and to form a sequence of ordered structures with increasing coverage. During the past year, a needle doser has been constructed in our stainless steel ultra-high vacuum (UHV) chamber, and it has been used to study the reaction of methane with the following surfaces: Clean Pd(100), O/Pd(100), Cl/Pd(100), and O/Cl/Pd(100). 12 refs., 1 fig., 2 tabs.

5922 **(DOE/PC/79935—5) Circulation in gas-slurry column reactors: Third quarterly report ending June 30, 1988.** Clark, N.; Kuhlman, J.; Celik, I. (West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering). 1988. Contract FG22-87PC79935. 36p. NTIS, PC A03/MF A01 - OSTI. Order Number TI89002268/JAW.

This is the third quarterly report on experimental and theoretical research into the hydrodynamics of bubble columns. To date an experimental column has been constructed and some preliminary measurements have been made of bubble phenomena using both resistance and suction probes. This suction probe has been shown to underestimate void fraction only slightly operating curves (void fraction versus gas superficial velocity) have also been obtained for the column at three different operating heights. An analysis of bubble size prediction from probe signals has been completed, numerical modeling has commenced and expertise has been acquired with a laser doppler velocimeter to measure local velocities in the column. Recent research has related the drift-flux model to bubble holdup in bubble columns. 23 refs., 17 figs.

5923 **(ETSU-L—24) Energy from municipal solid waste: the future.** Stronach, N.J. (UKAEA Harwell Lab. Energy Technology Div.). 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756041/JAW.

Municipal Solid Waste disposed of in the UK represents an energy resource of 13-14 x 10/sup 6/ tonnes coal equivalent every year (tce/yr). This includes both wastes arising in the domestic sector and also general industrial and commercial wastes. Waste disposal is dominated at present by landfilling without attempting any energy recovery. Currently only 4% of waste arising has its energy content exploited by direct means (i.e. before landfilling) whereas recent studies have suggested that up to 25% of the waste is disposed of at a cost which could make alternative schemes of energy recovery attractive. Recovery of energy as gas after landfilling is at present estimated to generate energy equivalent to an additional 120,000 tce/yr, but there remains a resource of 3.5 x 10/ sup 6/ tce/yr which could be tapped. The status of the various waste to energy technologies is summarized.

5924 **(SESC—1978) Biogas from farm animals.** (Solar Energy Society of Canada, Inc., Winnipeg, Manitoba). 1978. 14p. (CE—02077). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This booklet outlines the techniques for producing methane-containing biogas from farm manures by anaerobic digestion, and presents these techniques as a practical way of increasing energy supplies on farms in Alberta. Advantages include a reduction in waste volumes, lowering of pollution potential, production of a valuable fuel and fertilizer, and destruction of weed seeds and dangerous bacteria. Disadvantages include high initial costs, the need for time and manpower to operate the biogas system, and difficulty of operation in cold climates. Basic principles of design and operation of such systems are described. An important point for Alberta operators is the need for insulation and heating of the digestor. The potential for Alberta biogas production is estimated at around 16 million cubic feet per day from cattle alone. Uses for biogas on the farm are suggested, including space heating and cooking. Examples are presented from around the world to illustrate the practical possibilities and economics of installing biogas systems. 9 refs., 2 figs., 4 tabs.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 6157

5925 **(DOE/ER/13614—2) The microbiology and physiology of anaerobic fermentations of cellulose: Progress report, May 1987--October 1988.** Peck, H.D. Jr.; Ljungdahl, L.G. (Georgia Univ., Athens (USA)). 1988. Contract FG09-86ER13614. 23p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002348/JAW.

The long term goals of this research project are to define (1) the mechanism(s) of the activation of molecular hydrogen in terms of the nickel-sulfur, nickel-selenium and non-heme iron redox centers and (2) to understand the physiological role of hydrogenases in the metabolism of the sulfate reducing bacteria and other anaerobic bacteria. Toward these goals, the presence of three different hydrogenases, termed the (Fe) hydrogenase, the (NiS) hydrogenase and the (NiSe) hydrogenase, have been demonstrated in the sulfate reducing bacteria (18) gram qualities of the hydrogenases prepared, molecular biological studies initiated (5,13) and a bioenergetic mechanism demonstrated which requires two or more hydrogenases (3). The goals of our study were to obtain properties of extreme thermophilic anaerobes involved in the degradation of cellulosic material to understand better the process of biomass conversion and its possible industrial studying organisms which grow naturally together with cellulose degraders and those which can be grown in cocultures with cellulolytic and hemicellulolytic bacteria to obtain special fermentation products. It also includes the study of the ability of a group of extreme thermophiles to grow over an extended temperature span of 40{degree}c or more and to examine a forwarded theory on the nature of temperature tolerant thermophiles. 43 refs., 3 figs.

5926 **(NP—9770145) Ethanol production with immobilized cells.** Kressdorf, B. (Technische Univ. Braunschweig (Germany, F.R.). Naturwissenschaftliche Fakultaet). 10 Aug 1987. 160p. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770145/JAW.

Two carrier systems for whole-cell immobilization were improved, and a further system was developed. The new developments included the silicon caoutchouc matrix, a covalent network polymer with excellent mechanical properties. Ethanol was produced by means of yeast and by means of Zymomonas mobilis bacteria, which have a sixfold higher activity. The suitability of different Z. mobilis strains for molasse fermentation was investigated by a systematic analysis of the effects of different salts. Kinetic studies were carried out on immobilized Z. mobilis cells. Only the experiments in the continuous reactor with in-situ-produced ethanol were found to be successful. On the basis of a Michaelis-Menten approach, kinetics with non-competitive substrate inhibition and linear ethanol inhibition above a threshold concentration was found.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 5938

13 HYDRO ENERGY

1306 Environmental Aspects

5927 **(DOE/BP—1087) Conceptual plans for qualitatively and quantitatively improving artificial propagation of anadromous salmonids in the Columbia River Basin.** Bouck, G.R. (USDOE Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife). Sep 1988. 59p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003508/JAW.

Long-range planning is required to identify the resources and actions needed to produce additional hatchery fish and increase hatchery effectiveness. Given typical lead times, one can expect about 10--15 years to lapse between the time BPA requests authority for capital projects and the time the first adult fish return via that project. In this process, it is critical to establish "proximate," numerical fish production goals for planning purposes. The species of fish and the location of their production can be generalized for these purposes, albeit, these data must be refined into discrete, specific subbasin plans. For purpose of this report, generalized scenarios are used to identify possible solutions and their costs. For planning purposes a numerical goal for total salmon and steelhead production in the Columbia River Basin was set arbitrarily at 10 million adults per year. Given that the full propagation potential for wild/natural salmon/steelhead is about 3.5 million adults, and given that the current hatchery production of salmon/steelhead is about 2.5 million adults per year, therefore, hatcheries might need to produce as much as 4 million more adults per year (depending on the benefits of improved mainstem passage, and habitat restoration). 2 figs., 4 tabs.

5928 **(DOE/BP—1123) Lower granite pool and turbine survival study, 1987: Annual report FY 1987.** Giorgi, A.; Stuehrenberg, L. (National Marine Fisheries Service, Seattle, WA (USA). Northwest and Alaska Fisheries Center). Jun 1988. Contract AI79-87BP34270. 30p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004399/JAW.

Survival of yearling spring chinook salmon was estimated as they traversed Lower Granite Reservoir and passed through a turbine at Lower Granite Dam. Fish were PIT tagged at Rapid River Hatchery and transported to release sites near Asotin, Washington, and at Lower Granite Dam. Recovery ratios of treatment and control groups were used to estimate survival. Estimates were based on tags intercepted at both Lower Granite and Little Goose dams. Turbine survival was estimated to be 83.1% (95% CI = 74.1 to 92.2%). A qualified estimate of survival from Asotin to Lower Granite Dam for a single release group was calculated as 71.9%. Uncertainties associated with satisfying certain key mark and recapture statistical assumptions are examined. As a result of these uncer-

tainties, an alternate study design and analytical procedure are recommended for future investigations. 14 refs., 7 figs., 5 tabs.

5929 **(DOE/BP/11631—3) Smolt condition and timing of arrival at Lower Granite Reservoir: Annual report for 1986 operations.** Buettner, E.W.; Nelson, V.L. Sr. (Idaho Dept. of Fish and Game, Boise (USA)). Sep 1987. Contract AI79-83BP11631. 46p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004087/JAW.

This project monitored the daily passage of smolts during the 1986 spring outmigration at two migrant traps, one each on the Snake and Clearwater rivers. Average migration rates for freeze-branded chinook salmon smolts were 28.2 km per day and 22.1 km per day for steelhead trout smolts between release sites and the head of Lower Granite Reservoir. The yearling chinook salmon migration begins in earnest when Salmon River discharge makes a significant rise in early to mid-April. Most yearling chinook salmon pass into Lower Granite Reservoir in April followed by passage of steelhead trout in May. Chinook salmon smolt recapture data from the Snake River trap suggest a strong dependence of migration rate on quantity of Snake and Salmon River discharge, although no statistical correlation exists at this time. Daily and seasonal descaling rates were calculated for each species at each trap. Rates were highest for hatchery steelhead trout, intermediate for yearling chinook salmon, and lowest for wild steelhead trout. Descaling rates were generally higher in 1986 than those observed in 1984 and 1985. 4 refs., 9 figs., 15 tabs.

5930 **(DOE/BP/16480—4) Development of a vaccine for bacterial kidney disease in salmon: Annual report FY 1987.** Kaatari, S.; Chen, D.; Turaga, P.; Wiens, G. (Oregon State Univ., Corvallis (USA). Dept. of Microbiology). Jun 1988. Contract AI79-84BP16480. 61p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004408/JAW.

The goal of the project's fourth year was to test the immunogenicity and prophylactic value in coho salmon (Oncorhynchus kisutch) of various chemical conjugates of Renibacterium salmoniarum cell and major antigens. This was accomplished by assessing the serum antibody response, the cellular immune response (chemiluminescence), and the kinetics of mortality after lethal injections of the bacteria. The studies completed this year have: (1) identified immunization procedures which enhance the induction of high levels of antibody; (2) identified functionally distinct serum antibodies which may possess different abilities to protect salmon against BKD; (3) begun the isolation and characterization of anti-R. salmoniarum antibodies which may correlate with varying degrees of protection; (4) identified chemiluminescence as a potential method for assessing cellular immunity to bacterial kidney disease; and (5) characterized two monoclonal antibodies to R. salmoninarum which will be of benefit in the diagnosis of this disease. 39 refs., 16 figs., 3 tabs.

5931 **(DOE/BP/35245—1) Correlation of biological characteristics of smolts with survival and travel time: Annual report, FY 1987.** Rondorf, D.W.; Beeman, J.W.; Free, M.E.; Liljegren, D.E. (Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center). Sep 1988. Contract AI79-87BP35245. 109p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89004116/JAW.

The biological characteristics of smolts were examined to determine their effect on estimates of survival in the Columbia and Snake rivers. Freeze branded groups of steelhead trout (Salmo gairdneri) from Lyons Ferry State Fish Hatchery (SFH) and Wells SFH and spring chinook salmon (Oncorhynchus tshawytscha) from Winthrop National Fish Hatchery (NFH) were used to estimate survival. Past estimates of survival, using a ratio of test and control fish recaptured at McNary Dam, have resulted in estimates > 100%, presumably due to some unknown bias. Study objectives were to determine if stress and descaling, degree of smoltification, and prevalence of bacterial kidney disease (BKD) differed among test and control groups of fish, thereby biasing survival estimates. 19 refs., 20 figs., 10 tabs.

5932 **(DOE/BP/35333—1) Wildlife protection, mitigation, and enhancement planning---Dworshak Reservoir: Final report FY, 1987.** Kronemann, L.A. (Nez Perce Tribe, Lapwai, ID (USA). Wildlife Program). Jan 1988. Contract AI79-87BP35333. 153p. NTIS, PC A08/MF A01 - OSTI. Order Number DE89004115/JAW.

The impact to wildlife and habitat losses due to the construction and operation of Dworshak Dam on bald eagles and osprey were investigated for the 54 miles of the North Fork Clearwater River that was inundated by Dworshak Reservoir. Down stream impacts, and habitat losses due to Dworshak Dam were investigated for all target wildlife species that utilize the riparian area along the 42.5 miles of North Fork and lower Clearwater Rivers from the dam site to the confluence with the Snake River. The investigation was restricted to existing information. Changing the riverine habitat along the North Fork Clearwater River to one with unique reservoir characteristics has changed the ability of the North Fork Drainage to support past and present wildlife species that inhabited the area. The historical breeding grounds of bald eagles were reduced by increased human activities facilitated by the open access to Dworshak Reservoir and the permanent loss of historical salmon runs up the North Fork Clearwater River. The permanent loss of historical anadromous fish runs have had a negative impact on wintering eagles. The introduction of kokanee, however, has provided a replacement prey base, but only if the fishery is stable and reliable. 47 refs., 10 figs., 5 tabs.

5933 **(DOE/BP/39830—3) Lower Flathead System Fisheries Study, South Bay of Flathead Lake: Volume 3: Final report, 1983--1987.** Cross, D.; Waite, I. (Confederated Salish and Kootenai Tribes, Pablo, MT (USA)). Jun 1988. Contract AI79-83BP39830. 71p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003507/JAW.

The Lower Flathead System Fisheries Study assessed the effects of Kerr Dam operation on the fisheries of the lower Flathead ecosystem. South Bay, the southern most lobe of Flathead Lake, is the most extensive area of shallow water, and therefore, most effected by changes in lake levels. This study began in January of 1984 and was completed in early 1987. Vegetative and structural cover are relatively limited in South Bay, a condition which could contribute to lower recruitment for some fish species. Our data show that the study area contained 0.04% structural and 5.4% vegetative cover in June at full pool. Both figures are less than 1.0% at minimum pool. Structural complexity mediates the ecological interactions between littoral zone fish and their prey, and can affect local productivity and growth in fish. Structural complexity may also be important to overwinter survival of young perch in Flathead Lake. Winter conditions, including ice cover and fall drawdown, seasonally eliminate the vegetative portion of most rooted macrophytes in South Bay. This results in substantial loss of what little structural cover exists, depriving the perch population of habitat which has been occupied all summer. The loss of cover from draw-down concentrates and probably exposes perch to greater predation, including cannibalism, than would occur if structural complexity were greater. 33 refs., 10 figs., 5 tabs.

5934 **(DOE/BP/63584—2) Status and habitat requirements of white sturgeon populations in the Columbia River downstream from McNary Dam: Annual progress report, July 1987--March 1988.** Nigro, A.A. (ed.). (Oregon Dept. of Fish and Wildlife, Portland (USA)). Nov 1988. Contract AI79-86BP63584. 143p. NTIS, PC A07/MF A01 - OSTI. Order Number DE89003695/JAW.

We report on our progress from July 1987 through March 1988 on determining the status and habitat requirements of white sturgeon populations in the Columbia River downstream from McNary Dam. We found that a combination of setline and gillnet catches best represented the population of subadults and adults in The Dalles Reservoir. Crews caught 1041 fish and marked 837 fish. Our catch per unit effort in the upper one-half mile of the John Day Dam tailrace was five times that elsewhere in the reservoir. Sturgeon retained spaghetti tags and did not regenerate barbel and fin ray clips. Sturgeon did not retain tattoos. We conclude from our 1987 sampling that we can sample a variety of habitats and collect enough sturgeon of various sizes to describe population status, dy-

namics, reproduction, early life history and habitat requirements of stocks upstream and downstream from Bonneville Dam. We recognize that our sampling programs need to be adjusted to address some limitations in approach and are making necessary adjustments. We have not focused much effort on quantifying available spawning and rearing habitat, but will do so in 1988. The document is divided into four appendices.

5935 **(DOE/BP/64840—1) Cle Elum Lake sockeye salmon restoration feasibility study, 1987--1988: Annual report, FY 1987.** Flagg, T.A.; Mighell, J.L.; Slatick, E.; Harrell, L.W. (National Marine Fisheries Service, Seattle, WA (USA). Coastal Zone and Estuarine Studies Div.). Nov 1988. Contract AI79-86BP64840. 37p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004363/JAW.

In 1986, a multi-year project to evaluate the biological feasibility of reestablishing anadromous sockeye salmon (Oncorhynchus nerka) runs to Cle Elum Lake in the Yakima River Basin was established between the Bonneville Power Administration (BPA) and the National Marine Fisheries Service (NMFS). This program involves the capture, spawning, and rearing of disease-free donor stock in 1987 and 1988 and assessment of juvenile outmigration and survival from Cle Elum Lake in 1989 and 1990. Work in 1987--1988 involved collection of adult sockeye salmon from the Lake Wenatchee run and incubation and rearing of progeny as donor stock. In July 1987, 263 adults were captured at the Dryden fishway on the Wenatchee River and transferred to net-pens in Lake Wenatchee. Adults were held approximately 90 days and spawned, and the eggs were transferred to a quarantine hatchery. Pre-spawning survival was 95.1%, and all spawners were certified as being free of Infectious Hematopoietic Necrosis (IHN) and other replicating viruses. Egg viability averaged about 40%; however, eyed egg to hatch survival was over 99%. Juveniles are being reared in quarantine, and survival to date is about 92%. The NMFS currently has over 131,000 fry (0.7 g average weight) in culture. Fry have been certified twice (at 0.12 g and 0.25 g average weight) as being free of IHN and other replicating viruses. Viral certification will continue throughout rearing. 13 refs., 4 figs., 3 tabs.

14 SOLAR ENERGY

5936 **(PAI—8404) Renewable energy: innovation at work.** Passmore, J.; Jackson, R. (Passmore Associates International, Ottawa, Ontario (Canad)). 1984. 44p. (In French). (CE—02075). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This booklet outlines the various developments that have occurred in recent years in the field of renewable energy, and presents some of the innovative solutions used in developing renewable energy sources. In the area of solar energy, these include photovoltaically-powered houses, factories, automobiles, and remote power systems, as well as parabolic collectors for concentrating solar energy and solar ponds for energy storage. Other significant developments include solar production of hydrogen from water and industrial scale solar water heating systems in Ontario. The possibilities of using wind energy have been shown in Californian and European wind turbine installations, and in new sail designs for large ships. Biomass energy innovations include development of certain kinds of hitherto-neglected plants as sources for conversion to fuels, burning of wood or wood pellets, producing methane from manures and waste biomass, and use of ammonia and alcohol fuels. Other renewable energy projects described in this report include small hydroelectric power plants, wave energy converters, ocean thermal energy converters, fuel cells, and geothermal power plants. Developments in energy conservation and efficiency are also outlined, including the use of dirigibles in air transport, use of ice blocks formed during winter for air conditioning, flywheel energy storage, improved electric batteries, passive solar heating, energy conserving buildings, heat exchangers and heat pumps, and energy efficient appliances. 35 figs., 1 tab.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 5923, 5925, 5926, 6133

5937 **(DOE/CE/15337—T4) Edge-illuminated vertical multijunction solar cell: Fourth quarterly report, June 1988--September 1988.** Sater, B.L. (Sater (Bernard), Olmsted Falls, OH (USA)). 16 Oct 1988. Contract FG01-87CE15337. 4p. NTIS, PC A02 - OSTI. Order Number DE89003087/JAW.

Two-dimensional computer analysis of the VMJ solar cell is essentially finished. The analysis established optimum wafer and diffusion parameters for the wafers. In additional, various parameters such as each diffusion depth, doping profiles and the recombinations losses at ohmic contacts and exposed surface were studied for their sensitivity effects on overall performance. During this quarter some added theoretical analysis was done to see what results one could expect with the low minority-carrier lifetime initially obtained in initial diffusion attempt. The analysis shows low minority-carrier lifetime degrades performance and makes the cell much more sensitive to exposed surface recombination losses.

5938 **(IEA—9003806) Cumulative indexes, 1987.** (Institute for Industrial Research and Standards, Dublin (Ireland). Information Technology Group). 1987. 341p. Biomass Conversion Technical Information Service, Ballymun Road, Dublin 9, Ireland. Order Number TI89003806/JAW.

This volume contains the corporate author index, author index, and subject index for publications entered into the IEA Biomass Conversion Technical Information System during the year 1987. (DT)

5939 **(NP—9770123) Application and evaluation of informations from experiments for controlling the anaerobic treatment of wastes in a solid bed reactor with aerobic composting of the solids afterwards. Final report.** Jager, J.; Messerschmidt, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1986. 213p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770123/JAW.

In this research project information was gathered about controlling the anaerobic decomposition of solid wastes. Analogous to the degradation process taking place in a landfill experiments were made with different kinds of reactor configurations. Because the anaerobic biological process is multistage, examinations were made regarding the hydrolysis and the biodegradation of the waste. The results were applied to the planning of a plant for the waste treatment from a model community with 50.000 inhabitants. (orig.) With 50 refs.

5940 **(NP—9770143) Coenzyme F/sub 420/ as an agent to establish the biomass of methanogenic bacteria in biogas reactors.** Heine-Dobbernack, E. (Bundesforschungsanstalt fuer Landwirtschaft, Braunschweig (Germany, F.R.); Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Biotechnologie 1; Duesseldorf Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 1988. 201p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770143/JAW.

The relationship of the total intracellular concentration of the coenzyme F/sub 420/ to the biomass and metabolic activity of methanogenic bacteria was investigated in static cultures of M.barkeri with methanol and of M.byantii with H/sub 2/ and CO/sub 2/ as a substrate. In spite of distinct physiological differences, results with the two types of bacteria were essentially identical. The investigation proved the coenzyme F/sub 420/ to be a useful parameter for the biomass of methanogenic bacteria, but to be no measure of their metabolic activity. However, by using the content of coenzyme F/sub 420/ as a quantity of reference, one can establish a specific rate of methane production Q/sub CH4/ (F/sub 420/) and thereby assess the metabolic activity of the methane bacteria. Unlike conventional biomass parameters, the determination of coenzyme F/sub 420/ is a selective, fast, and sensitive method for determining methanogenic cell mass in complex mixed populations.

5941 **(SERI/SP—320-3328) Photovoltaics: Technical information guide: Second edition.** (Solar Energy Research Inst., Golden, CO (USA)). Aug 1988. Contract AC02-83CH10093. 112p. NTIS, PC A06/MF A01 - OSTI. Order Number DE88001184/JAW.

The guide is designed to help you find information about photovoltaics. It includes a brief history, some technology basics, and descriptions of current research and development activities. It was compiled primarily for engineers, scientists, university researchers, manufacturers, planners, librarians, and others needing a reference guide on photovoltaics. The references in this guide do not represent all the material that is available on a specific topic, however. Our objective was to identify what we believe to be the most helpful sources of information. The references were selected according to their relevance to a particular topic, how frequently they are cited in the professional literature, and their availability. The Photovoltaics Technical Information Guide, Second Edition, was produced by the Solar Technical Information Program for the US Department of Energy.

5942 **(SERI/STR—211-3417) An AlGaAs-GaAs patterned Ge tunnel-junction cascade concentrator solar cell: Final subcontract report, 15 October 1986--31 October 1987.** Timmons, M.L. (Solar Energy Research Inst., Golden, CO (USA); Research Triangle Inst., Research Triangle Park, NC (USA)). Sep 1988. Contract AC02-83CH10093. 59p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89000828/JAW.

This report describes research performed in several areas of AlGaAs/GaAs cascade technology. Annealing studies of p^+-Ge layers grown on p^+-GaAs substrates indicate that the Ge-GaAs interfaces are adequately stable to interdiffusional mixing if the interface thermal stress is limited to about 700{degree}C for 1 hour. Specific resistivities of intercell ohmic connections (IOC) remain below the goal of 2 {times} 10^{-4} ohm-cm^2. The thermal stability of the IOC dictates a growth-temperature limit for the AlGaAs top cell significantly lower than conventional organometallic vapor-phase epitaxial practice. Growing high-quality AlGaAs junctions at 700{degree}C or lower caused some difficulty. Minority-carrier-lifetime degradation was studied, but the causes of lifetime reduction remain largely unidentified. Selective epitaxy of the Ge IOC was developed. Slow etching resulted in substantial under-cutting of photolithographic patterns and created problems with reproducibility. The use of MCPMg appears to be suitable for p-type doping in both GaAs and AlGaAs cell growth. Causes of the relatively poor performance of AlGaAs grown at low temperatures merit further research, since this system is important for solar cells. 13 refs., 16 figs., 4 tabs.

1406 Photovoltaic Power Systems

5943 **(DOE/ET/20485—T4) Report of refurbishment of Utirik photovoltaic system.** Ratajczak, A.F. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 11 Oct 1988. Contract AI01-76ET20485. 20p. NTIS, PC A03 - OSTI. Order Number DE89003988/JAW.

This report describes the repairs and modifications made to the Photovoltaic Power system installed on the island of Utirik in the Republic of the Marshall Islands in the Micronesia region of the Pacific.

1408 Ocean Energy Systems

5944 **Mixing depth of a submerged, horizontally injected buoyant jet.** Johnstone, H.W.; Zangrando, F. (F and D Associates, Ltd., 732 North Stone Ave., Tucson, AZ (US)). *Journal of Solar Energy Engineering;* **110**: No. 2, 125-131(May 1988).

Tests in the laboratory were conducted to determine the effective mixing depth of turbulent buoyant fluid injected horizontally into an initially unstratified environment through a radial, deeply submerged diffuser. The diffuser was moved slowly during the experiments, at a rate much smaller than the entrainment and mixing process. The effective mixing depth is defined as the relative position between the initial injector level and the lowest position of the resulting mixed layer over which the injected fluid is deposited. Results have applications to discharge of contaminants and heat into large reservoirs (sewage disposal, power plants, OTEC systems) and establishment of a stratified region as is required for operation of salt gradient solar ponds. A functional dependence between mixing depth, scaled by the injector slot-size, and injector Froude number was found. Dependence on submergence was not found for the large submergence values tested; dependence on diffuser radius was not investigated. The laboratory data compare well with results obtained in a reservoir of 3355 m/sup 2/ surface area and indicate a strong dependence of effective mixing depth on the Froude number.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 5948, 6107

5945 **(OME—40M-8-77) Turn on the sun.** (Ontario Ministry of Energy, Toronto (Canada)). 1977. 45p. (CE—02082). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This booklet serves as a guide for residential solar heating in Ontario. Principles of solar collectors, passive solar heat gain, active solar heating systems, solar water heating, and swimming pool heating are described. In a section intended to help the homeowner decide whether or not to install solar equipment, information on performance, reliability, and cost of various components is presented. Life-cycle costing methodologies are included. Once a decision to install a solar heating system has been made, the next step is to choose the system best suited to individual needs; some principles are given to help choose a system and to size it correctly. To minimize solar system requirements, it is recommended that stringent energy conservation measures be taken, such as improved insulation and sealing. The booklet concludes with descriptions of nine demonstration houses in Ontario, showing different ways of using solar energy. 77 refs., 46 figs., 6 tabs.

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

5946 **(UCID—21484) Preliminary report on shallow research drilling in the Salton Sea region.** Newmark, R.L.; Kasameyer, P.W.; Younker, L.W. (Lawrence Livermore National Lab., CA (USA)). 14 Jan 1988. Contract W-7405-ENG-48. 74p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003716/JAW.

During two shallow thermal drilling programs, thermal measurements were obtained in 56 shallow (76.2 m) and one intermediate (457.3 m) depth holes located both onshore and offshore along the southern margin of the Salton Sea in the Imperial Valley, California. These data complete the surficial coverage of the thermal anomaly, revealing the shape and lateral extent of the hydrothermal system. The thermal data show the region of high thermal gradients to extend only a short distance offshore to the north of the Quaternary volcanic domes which are exposed along the southern shore of the Salton Sea. The central thermal anomaly has an arcuate shape, about 4 km wide and 12 km long. Across the center of the anomaly, the transition zone between locations exhibiting high thermal gradients and those exhibiting regional thermal gradients is quite narrow. Thermal gradients rise from near regional (0.09{degree}C/m) to extreme (0.83{degree}C/m) in only 2.4 km. The heat flow in the central part of the anomaly is greater than 600 mW/m{sup 2} and in some areas exceeds 1200 mW/m{sup 2}. The shape of the thermal anomaly is asymmetric with respect to the line of volcanoes previously thought to represent the center of the field, with its center line offset south of the volcanic buttes. There is no broad thermal anomaly associated with the magnetic high that extends offshore to the northeast from the volcanic domes.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 6539

5947 **(DOE/ID/12478—T14) Geothermal technology transfer for direct heat applications: Final report, 1983--1988.** Lienau, P.J.; Culver, G. (Oregon Inst. of Tech., Klamath Falls (USA). Geo-Heat Utilization Center). 1988. Contract FG07-83ID12478. 58p. NTIS, PC A04/MF A01. Order Number DE89001968/JAW.

This report describes a geothermal technology transfer program, performed by Oregon Institute of Technology's Geo-Heat Center, used to aid in the development of geothermal energy for direct heat applications. It provides a summary of 88 technical assistance projects performed in 10 states for space heating, district heating, green-houses, aquaculture, industrial processing, small scale binary electric power generation and heat pump applications. It describes an inventory compiled for over 100 direct heat projects that contains information on project site, resource and engineering data. An overview of information services is provided to users of the program which includes; advisory, referrals, literature distribution, geothermal technology library, quarterly Bulletin, training programs, presentations and tours, and reporting of activities for the USDOE Geothermal Progress Monitor.

1510 Direct Energy Utilization

5948 **(NMRDI—2-72-4214) Design and construction of the NMSU Geothermally Heated Greenhouse Research Facility: Final technical report.** Schoenmackers, R. (New Mexico Solar Energy Inst., Las Cruces (USA)). Nov 1988. 38p. NTIS, PC A03/MF A01 - New Mexico Research and Development Inst., Suite M, 457 Washington SE, Albuquerque, NM 87108. Order Number DE89003700/JAW.

This report describes the design, construction, and performance of the New Mexico State University (NMSU) Geothermal Greenhouse Research Facility. Two 6000-square-foot greenhouses were built on the NMSU campus and supplied with geothermal energy for heating. The geothermal water is pumped from one of three wells producing water at temperatures from 141{degree}F to 148{degree}F. Heat is delivered to the greenhouse space by means of overhead fan-coil unit heaters. The two greenhouses are double-glazed on roof and wall surfaces employing a total of four different film materials: Tedlar{Reg←Sign}, Melinex{Reg←Sign}, Softglass{Reg←Sign}, and Agrifilm{Reg←Sign}. One greenhouse is cooled using a traditional fan and pad cooling system. The second greenhouse is cooled with a high-pressure fog system and natural ventilation through roof and side vents. A 2400-square-foot metal building next to the greenhouses provides office, work, and storage space for the facility. The greenhouse facility was leased to two commerical tenants who produced a variety of crops. The performance of the greenhouses was monitored and reported both qualitatively and quantitatively. Results from the tenant's pilot-scale studies in the NMSU greenhouse facility were transferred and applied to two commercial greenhouse ranges that were built in southern New Mexico during 1986/87. 9 figs., 5 tabs.

16 TIDAL AND WAVE POWER

1604 Economics

5949 **(ATPPB—6910) Feasibility of tidal power development in the Bay of Fundy.** (Atlantic Tidal Power Programming Board, New Brunswick, Nova Scotia (Canada)). 1969. 33p. (CE—02072). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

A committee was formed to carry out technical studies on the feasibility of a tidal power plant in the Bay of Fundy. Basic information was collected on the physical, geological, climatic, and tidal characteristics of the area to determine areas for more intense investigation. Studies were conducted on the possible effects of the plant on navigation, ground transportation, fisheries, and area development. Electric power marketing and transmission were also examined, as well as the basic concepts for extracting tidal energy. A number of potential sites were examined, and the three most promising sites were selected for preliminary design and cost estimates. Computerized models were used at appropriate stages in order to evaluate various tidal power schemes. This report presents a summary of the committee's investigations. It was seen that a site at the entrance to Cobequid Bay would have an economic advantage over the other sites considered. From the results of the design studies, it was concluded that a long period of construction, plus extensive capital investment, would be required. However, the lowest unit cost of output was calculated at 5.6 mills/kWh, substantially above the incremental cost of energy available from existing sources. Under current economic conditions, the tidal power plant would not be feasible. 4 figs., 1 tab.

1607 Tidal Power Plants

REFER ALSO TO CITATION(S) 5949

17 WIND ENERGY

REFER ALSO TO CITATION(S) 5936

5950 **(SERI/TP—217-3367) Wind energy research at the Solar Energy Research Institute.** Noun, R.J.; Dodge, D.M. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 8p. (CONF-8806247—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89000807/JAW.

From International workshop on renewable energy in developing countries; Kiryat Anavim, Israel (12 Jun 1988).

As world interest in wind energy research and development (R&D) emerged in the mid-1970s, the path to the commercialization of wind power seemed clear, straightforward, and relatively short. In the United States, a fledgling industry foresaw small, 10-kW wind machines spinning in suburban and rural backyards, providing a fully dispersed new power source that would provide low-cost electricity to thousands of Americans. The US government envisioned an equal number of large, utility-owned, multimegawatt wind turbines turning majestically in far-spaced rows across the Great American Plains to supplement existing coal-fired, oil, hydroelectric, and nuclear plants. Typically, both of these visions have proven to be inaccurate, at least so far; what we have in the United States are closely spaced rows of privately owned, intermediate-sized wind turbines (numbering more than 17,000), primarily on the coastal hills and inland plains of California. From two separate programs addressing different concerns, the SERI wind research program has emerged as the primary horizontal-axis wind turbine research center in the United States. In SERI's view, the flexible high-performance wind turbines developed by US manufacturers offer great potential for the US and world markets. This includes the potential for scaleup to the larger sizes (250 kW to 1 MW). Our principal research challenge in the next few years is to acquire the data, develop the analytical design tools, and explore the advanced component and systems concepts that will help improve the performance and reliability of these systems and help usher in a new era of wind technology to meet world energy needs. 3 figs.

1704 Economics

REFER ALSO TO CITATION(S) 6093

5951 **(TAU—RE102) 1986 Monitoring summary of four small power production facilities interconnected with TransAlta Utilities.** (TransAlta Utilities Corp., Calgary, Alberta (Canada)). 1987. 8p. (CE—02061). TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, Alta., Canada T2P 2M1; $N/C.

This report summary presents some of the information and data contained in the 1986 monitoring summary of four interconnected wind power production facilities. Specifically, information was collected both on the operation of the wind power electric and

on their interaction with utilities in Alberta. Data were collected in 1986 at four sites interconnected with TransAlta Utilities: a 5 kW wind generator near Cardston, a 25 kW wind generator near Walsh, a 5 kW wind generator near Pincher Creek, and a 40 kW wind generator also near Pincher Creek. The wind generator near Walsh was fully installed and monitored for October through December only, inclusive, during 1986. During 1986, wind power producers generated a gross total of 128,298 kWh of electric energy, In general, electric energy generated by a wind generator was primarily used to meet his needs at the time of generation. However, when energy generated exceeded his immediate needs, the excess energy was banked in TransAlta's electric system. During times of low or no winds, this banked energy could be withdrawn from the electric system to meet the producers needs. 6 tabs.

5952 **(TAU—RE103) 1987 Monitoring summary of four small power production facilities interconnected with TransAlta Utilities.** (TransAlta Utilities Corp., Calgary, Alberta (Canada)). 1988. 8p. (CE—02060). TransAlta Utilities Corporation, 110-12th Ave. SW, PO Box 1900, Calgary, Alta., Canada T2P 2M1; $N/C.

This report summary presents some of the information and data contained in the 1987 monitoring summary of four interconnected wind power production facilities. Specifically, information was collected both on the operation of the wind power facilities, and on their interaction with electric utilities in Alberta. Data were collected in 1987 at four sites interconnected with TransAlta Utilities: a 5 kW wind generator near Cardston, a 25 kW wind generator near Walsh, a 5 kW wind generator near Pincher Creek, and a 40 kW wind generator also Pincher Creek. During 1987 the wind power producers generated a gross total of 130,519 kWh of electric energy. In general, electric energy generated by producer's wind generator was primarily used to meet his needs at time of generation. However, when energy generated exceeded his immediate needs, the excess energy was banked in TransAlta's electric system. During times of low or no winds, this banked energy could be withdrawn from the electric system to meet the producer's needs. 3 figs., 6 tabs.

1706 Wind Energy Engineering

5953 **(DOE/NASA—0015-1) Improving the fatigue resistance of adhesive joints in laminated wood structures.** Laufenberg, T.L.; River, B.H.; Murmanis, L.L.; Christiansen, A.W. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Forest Service, Madison, WI (USA). Forest Products Lab.). Aug 1988. Contract AI01-76ET20320. 95p. (NASA-CR—182165). NTIS, PC A05/MF A01 - OSTI. Order Number DE89003778/JAW.

The premature fatigue failure of a laminated wood/epoxy test beam containing a cross-section finger joint was the subject of a multidisciplinary investigation to assess and advance the technology of adhesive joints in composite wood structures. This investigation, which has wide-spread applicability to all adhesively bonded joints, included (1) analysis of the data collected during fatigue testing, (2) microscopic examination of failed and unfailed surfaces and materials, (3) chemical characterization of the adhesive resin and its cure in the presence of wood and asbestos fibers, (4) testing of the filled adhesive on various adherent systems for its mechanical properties and its performance in prototype finger joints, and (5) analysis of the finger joint's load-carrying capabilities, including the effects of specific design modifications. Four major problem areas were identified which appeared to contribute to the premature fatigue failure. Recommended solutions of these problems would reduce the void content in the veneer-veneer and finger joint bondlines, provide a well-configured finger tip for the joint, improve the adhesive's penetration and bonding to the wood substrate, and provide a cleanly-machined surface. 2 refs., 11 figs., 2 tabs.

5954 **(FAO—88016478) Wind pumping applications.** (Food and Agriculture Organization of the United Nations, Rome (Italy)). 10 Oct 1986. 132p. (CONF-8610443—1). U.S. Sales only (ETDE). Order Number DE88016478/JAW.

From Technical meeting on wind pumping applications; Rome, Italy (10 Oct 1986).

The technical meeting on "wind pumping applications" held in Rome following the "European Wind Energy Conference" (WEWC 86), has been organized jointly by the Wind Energy Project of ENEA-FARE and FAO/CNRE Working Group on Wind Energy Applications for Rural Areas, with the aim: to fill a gap in the international area where no specifical conference is devoted to small size wind turbine technology, such as wind pumping; to make an up to date state of art of the main collaboration programs in the sector among industrialized European and Developing; to point out some strategical needs for future activities in the Developing Countries. It was a great pleasure for all of us to have such first meeting in Italy with a qualified participation of experts coming from European and Developing Countries. More than 60 people of 15 countries, have attended the meeting with technical contributions and suggestions on near future prospects. Fourteen papers have presented, showing the state of art of this technology and the collaboration programs being carried out. Many pumping system configurations have been illustrated with test data, on shop or on field, for electric and mechanical trasmission, on the compressed air systems and on traditional and innovative multiblades.

5955 **(NP—9770127) Development and testing of wind power plants for space heating purposes. Final report.** Witt, H. (Witt und Sohn G.m.b.H. und Co., Pinneberg (Germany, F.R.)). 4 Sep 1987. 25p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770127/JAW.

The final report summarizes the results obtained during the development and testing of wind-powered water brakes for space heating purposes. Relatively simple and inexpensive plants were found to be generating relatively large amounts of energy in the form of heat. With noise pollution found to be at surprisingly low levels plants can be errected right next to or even on the roofs of residential buildings. While investment costs are lower and energy yields are higher than those of generating wind converters, wind-powered water brakes are less efficient considering the fact that competing fossil energy sources are much cheaper than electric power from nuclear power plants or coal-fired power plants the power generating plants are competing with.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 5782

5956 **(ANL/EES-TM—354) Review and implementation of models for evaluation advanced fossil-fueled technologies.** VanKuiken, J.C. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Sep 1988. Contract W-31109-ENG-38. 51p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89001863/JAW.

This study describes the results of the first phase of an investigation of the capability of existing computer models to evaluate the cost and performance tradeoffs of advanced, fossil-fuel-fired, electrical generating technologies. The Phase 1 objective was to review existing modeling packages and select an appropriate one for implementation. Thirty-one models and data bases were initially identified as potential candidates. After screening criteria were applied, seven were chosen. One of the seven models was a long-term system expansion model, the Electric Generating Expansion Analysis System (EGEAS) developed by the Electric Power Research Institute. Two test cases were conducted in Phase 1 to test the basic functions of EGEAS. Results verified that the model was functioning as prescribed and could be used in Phase 2. Phase 2 will extensively test the selected models. 47 refs., 7 figs., 11 tabs.

5957 **(DOE/CE/40716—2-Vol.1) Assessment of high pressure heat exchange systems technology: Volume I, technology assessment and research and development needs.** (Mueller Associates, Inc., Baltimore, MD (USA)). Oct 1987. Contract AC01-84CE40716. 105p. NTIS, PC A07/MF A01 - OSTI; 1; GPO Dep. Order Number DE88012477/JAW.

Research and development appropriate to the Dept. of Energy and to a new generation of advanced heat exchangers which could operate in high-pressure, high-temperature industrial process applications near 2000{degree}F and 1000 psia and often involving corrosive gas streams, is recommended. This study identified and assessed potential applications in power generation using closed-cycle and other gas turbine configurations, steam reforming of natural gas, chemical evaporators for caustics and acids, transfer of heat energy to or from very hot or hostile waste gases, and heat transfer piping for flowing molten metal or liquids. Energy and cost savings on a process and national basis were estimated. 32 refs., 13 figs., 15 tabs.

5958 **(EPRI-CS—5501-Vol.3) AFBC [atmospheric fluidized-bed combustion] conversion at Northern States Power Company: Volume 3, Demolition and relocation: Final report.** Grieve, R. (Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA)). Nov 1988. 181p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004095/JAW.

This document is the third volume in a series of four reports detailing the conversion of Northern States Power Company's Black Dog Unit 2 from pulverized coal firing to atmospheric fluidized-bed combustion (AFBC). This particular report describes the demolition and relocation of equipment and systems at Unit 2, prior to the installation of the new AFBC system. The purpose of these reports is to share the information gathered during the Black Dog Unit 2 Conversion Project and present it so that other utilities can evaluate the technical feasibility and cost effectiveness of converting units within their systems from pulverized coal to AFBC. To this end, each volume in this series of reports presents material concerning a different aspect of the Black Dog project as shown in the following breakdown: Volume 1--Project Origins; Volume 2--Unit Design; Volume 3--Unit Demolition and Relocation; Volume 4--Unit Construction. 17 figs., 8 tabs.

5959 **(EPRI-CS—5581-SR) First international conference on improved coal-fired power plants: Conference proceedings.** Armor, A.; Bakker, W.; Jaffee, R.; Touchton, G. (eds.). (Electric Power Research Inst., Palo Alto, CA (USA)). 1988. 1,507p. (CONF-8611272—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003035/JAW.

From 1. international conference on improved coal-fired power plants; Palo Alto, CA, USA (19 Nov 1986).

The conference covered world wide developments in fossil fuel power plants for existing combustion options and emerging technologies such as fluidized bed combustion, and integrated gasification combined cycle. Included in these proceedings are papers from the following sessions: National and Overseas Projects, Boiler Design and R&D, Turbine Design and R&D, Boiler Materials and Components, Turbine Materials and Components, and Balance of Plant: Design and Materials. Individual projects are processed separately for the data bases.

5960 **(NP—9770103) Ceramic thermal barrier coatings for gas turbine components exposed to hot gases. Final report.** Buergel, R.; Chu, W.F.; Gruenling, H.W.; Leiter, G.; Rohr, F.J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1987. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770103/JAW.

The aim of the study was to develop ceramic thermal barrier coatings which are sufficiently corrosion resistant under crude oil firing conditions. The thermal cycling resistance should be as good as for conventional ZrO/sub 2/-8Y/sub 2/O/sub 3/ systems. In a screening phase of the programme various ceramic systems were evaluated which based i) on the ZrO/sub 2/-Y/sub 2/O/sub 3/ system and ii) on Al/sub 2/O/sub 3/-TiO/sub 2/ and Al/sub 2/O/sub 3/-Cr/sub 2/O/sub 3/. Further tests were concentrated on coatings of the ZrO/sub 2/-Y/sub 2/O/sub 3/-SiO/sub 2/-(Al/sub 2/O/sub 3/) type. The plasma sprayed layers exhibited less corrosion resistance in Vanadium containing atmospheres than the reference system ZrO/sub 2/-8Y/sub 2/O/sub 3/. Envelopment of ZrO/sub 2//Y/sub 2/O/sub 3/ crystallites by silicates did not occur. The thermal shock resistance was worse compared to the ZrO/sub 2/-8Y/sub 2/O/sub 3/ system despite a wide variety of tested parameters. Microsegmentation could not be achieved to a sufficient extent in order to make the ceramic strain tolerant. For these reasons the goals of the project could not be met. (orig.) With 11 refs., 4 tabs., 13 figs.

5961 **(OH/RD—87-211-K) Nanticoke TGS-turbine blade/disc investigation 3-D finite element stress analysis.** Ishac, M.F.; Byrne, T.B. (Ontario Hydro Research Div., Toronto (Canada)). 1987. 56p. (MICROLOG—88-00159). Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., Canada M8Z 5S4; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In November, 1983, a turbine blade failure at the blade root top serration fillet of one of the units at Nanticoke (Ontario) Thermal Generating Station resulted in a forced shut-down. Following this blade failure, two independent stress analysis investigations were carried out. The recent discovery of cracks at new locations of the blade root in another unit at Nanticoke created a need to extend the previous investigations and create an improved finite element model to carry out a more detailed stress analysis throughout the blade and the disc. This finite element model included the vane, the platform, the blade root and disc, with no locking groove. The objective of this analysis is to investigate the global mechanical behaviour of the turbine blade-disc attachment due to the centrifugal loading. It is a step towards understanding the mechanisms and causes of blade failure. The stress results indicate that the complex vane/root interaction (without the locking groove) is creating the high stresses at the locations of crack initiation. 6 refs., 15 figs.,

5962 **(PNL—5595) SYSPLAN: Model documentation and users' guide.** Hostick, C.J.; Hutchinson, R.A.; Winter, C. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1986. Contract AC06-76RL01830. 94p. NTIS, PC A05/MF A01 - OSTI; 1; GPO Dep. Order Number DE88007355/JAW.

This report describes software designed to evaluate capital investment in customer-side-of-the-meter load leveling battery systems. The microcomputer-based software was developed at the Pacific Northwest Laboratory (PNL), which is operated by Battelle Memorial Institute for the U.S. Department of Energy (DOE). Load leveling battery systems reduce a customer's monthly electrical demand charge by reducing the maximum power load supplied by the utility during the customer's peak demand. The system consists of a large array of batteries, a converter that changes AC current into DC current (or DC current into AC current), and balance-of-plant equipment and facilities required to support the battery and converter system. Using the software described in this report, the economic feasibility of load leveling systems can easily be evaluated to determine if more detailed studies are warranted. 27 figs., 2 tabs.

2002 Environmental Control Technology

REFER ALSO TO CITATION(S) 5782, 5783, 5784, 5956

5963 **(DOE/MC/22230—2598) Development of a unique system for the combined removal of sulfur compounds and fine particulates from hot coal derived fuel gases: Final report.** Pote, B. (TRW, Inc., Redondo Beach, CA (USA)). Jun 1987. Contract AC21-86MC22230. 349p. NTIS, PC A15/MF A01 - OSTI. Order Number DE88010259/JAW.

A system for the combined high temperature removal of reduced sulfur compounds and fine particulate matter contained in coal derived gas streams is being developed. The hot gas cleanup process is based on the use of calcium based ultrafine sulfur sorbent particles. Under normal conditions, the sorbent powders are highly cohesive and are not applicable to processes requiring pneumatic transport, gas-solids fluidization and cyclone separation. The sorbents, however, were physically mixed with a special fibrous carbonaceous material which has been developed at TRW, Inc. When admixed with the normally cohesive powders, the carbon imparts desirable fluid dynamic properties to the binary material mixture

which allows the use of a circulating fluid bed reactor as the hot gas cleanup device. Depending on the sorbent selected as little as 5% to as high as 15% by weight addition of fibrous carbon was sufficient to impart acceptable gas phase fluidization to the cohesive powders based on cold flow fluidization tests. When the binary material mixture was evaluated for sulfur capture in simulated coal derived gas streams, the level of gaseous sulfur species converted to a solid sulfide was essentially complete. The level of sorbent utilization (sulfur loading) while maintaining 90% gaseous sulfur removal was typically 80% of the stoichiometric value. These results were typical of all the sorbents tested, independent of the starting form of the sorbent. 13 refs., 95 figs., 56 tabs.

5964 **(DOE/PC/79796—T5) Enhancing the use of coals by gas reburning-sorbent injection: Quarterly report No. 5, June 1, 1988--August 31, 1988.** (Energy and Environmental Research Corp., Irvine, CA (USA)). 23 Sep 1988. Contract FC22-87PC79796. 54p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003311/JAW.

The objective of this project is to demonstrate gas reburning-sorbent injection (GR-SI) emission control technology on three pre-NSPS coal-fired utility boilers in Illinois. The project goals are to achieve NO/sub x/ and SO/sub x/ emission reductions of 60 percent and 50 percent, respectively. Work progressed on all tasks of the project. Revised costs and schedules for Phase 1 were submitted to the funding organizations and negotiations were completed with all except one major subcontractor. Baseline tests were conducted at all three host sites. Process design studies included isothermal flow modeling, heat transfer and combustion flow modeling, evaluation of precipitator performance with GR-SI, and small scale combustion tests to generate ash for disposal evaluation. These results are being translated into hardware designs in the project engineering task. Complete bid packages will be ready next quarter. Work in the environmental area focused on preparation of the Environmental Information Volumes for DOE's National Environmental Policy Act compliance review. A memo-to-file indicating compliance for the tangentially fired site was filed. However, complete environmental assessments will be required for the other two sites. Three technical presentations were made on the process to continue technology transfer. 8 figs.

5965 **(DOE/PC/91024—T8) Characterization and fundamental studies on CuO sorbent materials to determine attrition mechanisms on substrate gamma alumina: Technical progress report No. 7, March 23, 1988--June 23, 1988.** Mote, J.D.; Eucker, P.; Naziripour, A.; Zillman, W. (Denver Univ., CO (USA). Dept. of Engineering). 1988. Contract AC22-86PC91024. 14p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003091/JAW.

In the last two quarterly reports the influence of microstructure such as pore size, pore distribution and surface roughness on the mechanical properties of 1/16 inch UOP gamma alumina spheres was discussed. In the present quarterly report the identical investigation is carried out on 1/8 inch Alcoa gamma alumina materials. In the second part of this quarterly report, the results of the mechanical properties of UOP materials at elevated temperatures are presented. 10 figs., 1 tab.

5966 **(NP—9770107) Study on noise pollution control of flue gas desulfurization plants.** (Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.); Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (Germany, F.R.)). 1987. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770107/JAW.

This study on noise pollution caused by flue gas desulfurization machinery contains the results of a literature search for discussions with crucial manufacturers and operators of such plants, as well as measurements carried out by the TUEV on the actual equipment. In order to characterise such a complex system, the flue gas desulfurization plant is broken down into 4 sections from the process engineering aspect for the purposes of this study: supply, cleaning, waste disposal and flue gas line. Process-specific noise sources are analysed, described and sound-profiled for each section. These descriptions are supplemented with octave or terce spectra. Technically feasible ways of reducing noise from the main sources for each section are described, leading to 5 noise abatement stages for FGD plants. The strategy followed in this development of noise abatement measures is oriented towards acoustic aspects aimed at achieving the greatest overall effect on total noise from the plant by reducing noise from the worst individual offending parts of the plants.

5967 **(NP—9770130) Air pollution abatement and fluidized-bed combustion plants.** Eggersdorfer, R.; Faltin, M.; Fischer, B. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.); Hessisches Ministerium fuer Wirtschaft und Technik, Wiesbaden (Germany, F.R.)). Jan 1988. 241p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE89770130/JAW.

An environmentally compatible combustion of coal in cogeneration plants requires the development and use of low-cost methods complying with the principles of air/water pollution abatement as well as with the regulations of waste management. Efforts which on a world-wide scale have for some years been going into the testing of fluidized-bed combustion have proved it to be a technology promising to fulfil above requirements. The study summarizes the present knowledge concerning the environmental compatibility of fluidized-bed combustion systems. It points out the economic conditions allowing to evaluate the technology's maturity and feasible uses and evaluates stationary fluidized-bed combustion emissions, quasi-stationary fluidized-bed combustion emissions (thorough recirculation of fly ashes), circulating fluidized-bed combustion, pressurized fluidized-bed combustion as well as different fuels with high-grade hard coal and inert coal as the most important ones. With low-level emissions and residuals circulating fluidized-bed combustion systems are at present considered the most appropriate ones for medium-scale industrial and municipal uses.

5968 **(OH/RD—87-146-K) LIF waste characterization for handling/disposal - 1986. Executive summary.** Golomb, A. (Ontario Hydro Research Div., Toronto (Canada)). 1987. 49p. (MICROLOG—88-00149). Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., Canada M8Z 5S4; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Extended testing of direct limestone injection into the furnace (LIF) for acid gas control is scheduled to be held at Lakeview Thermal Generating Station (Ontario). To generate useful design data for improved handling/disposal of wastes from the furnace sorbent injection process, detailed waste characterization has been carried out on selected worst case (highest CaO) wastes from two previous trials at Lakeview, and on two wastes derived from pilot-scale tests. The samples were examined in terms of principal chemical and physical properties, before and after fixation by water addition. The highest solid waste CaO contents (~400 g/kg) were associated with the highest rates of sorbent injection (Ca/S ratio ~4.0). Exothermicity was about -100 cal/g whether limestone or slaked lime was injected. Likewise, bulk exothermicity tests gave internal stalking temperatures of about 160-190/sup 0/C with either sorbent, accompanied by significant expansion. In terms of engineering characteristics (eg. permeability, shear strength) the fixated wastes resembled regular fly ash and certain earth materials. The wastes were subjected to standard leachate extraction tests both as received and after fixation. LIF wastes were found to be essentially non-hazardous (ie, non-"leachate toxic") and suitable for use as landfill or backfill. 6 refs., 13 figs., 13 tabs.

5969 **(OH/RD—87-199-K) Electrostatic precipitation of dust resulting from the combustion of coal in power plants fitted with dry SO/sub 2/ controls - a literature review and preliminary assessment.** Mills, D. (Ontario Hydro Research Div., Toronto (Canada)). 1987. 15p. (MICROLOG—88-00134). Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., Canada M8Z 5S4; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Electrostatic precipitators (ESPs) currently in use at coal-fired generating stations were designed to collect flyash alone. Pro-

posed methods of dry SO/sub 2/ reduction through the addition of lime or limestone ahead of the precipitators will produce large amounts of high resistivity flyash/sorbent particulate matter, and it is anticipated that modifications to the ESP will be required to meet emissions limits. This paper reviews the basic mechanism of ESP operation, the effect of various operating parameters on ESP performance and describes some of the methods that have been proposed in the recent literature to upgrade their performance. These include pulse energization, addition of a cold-pipe precharger or mechanical precleaner, and installation of additional collectors after the existing ESPs. 15 refs., 1 fig.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 6248

5970 **(ECRC/M—2283) High frequency sound and its application to ground mounted switchgear.** Rushforth, S.C. (Electricity Council Research Centre, Capenhurst (UK)). Aug 1988. 7p. Available from: Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

Water ingress into chambers containing dielectric oil and compound causes many problems some of which can result in dangerous occurrences. The ability to determine the degree of degradation of the content of these chambers without de-energising the plant will be of great benefit. Some solutions to this problem are described in this report, involving the use of piezoelectric transducers to generate acoustic pulses ranging between 0.2 and 25 MHz.

5971 **(ECRC/M—2299) Automatic computer controlled weather actuated camera system for the investigation of snow accretion on overhead lines.** Eeles, W.T.; Wareing, J.B.; Strutt, I.; Castle, D.A.; Amor, K. (Electricity Council Research Centre, Capenhurst (UK)). Sep 1988. 5p. Available from: Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

An experiment is in the initial stages of investigating snow accretion on various types of overhead conductors. Laboratory experiments using paper tissue in a flowing liquid to simulate wet snowfall have indicated that certain conductor shapes could be less susceptible to accretion than conductors in general use at present. The next stage involves the setting up of field experiments on a small number of conductors. Meteorological instruments and snow detectors monitor the environmental conditions and feed data into a single board microcomputer system. The data can be downloaded via a serial interface when the film is collected at periodic intervals. The paper details the station construction and mode of operation.

5972 **(ECRC/R—2287) Discharge measurements in cables using a solid state 30kV bipolar low frequency generator.** Kearley, S.J.; MacKinlay, R.R. (Electricity Council Research Centre, Capenhurst (UK)). Aug 1988. 5p. Available from: Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

This report describes a portable solid state 30kV bipolar low frequency generator recently developed at E.C.R.C. The design is a linear amplifier based on series connection of high voltage field effect transistors. It can produce any waveform into any length of cable (within its current capabilities), and the noise on its output is significantly lower than that of designs based on high frequency switching. This makes it suitable for low-level discharge measurements on cables in the field.

5973 **(OH/RD—87-52-K) Cold load pickup experience at MEA utilities.** Cress, S.L. (Ontario Hydro Research Div., Toronto (Canada)). 1987. 46p. (MICROLOG—88-00136). Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., Canada M8Z 5S4; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A survey of Ontario municipal utilities indicated that there is a need for standard guidelines, for sizing distribution transformers and transformer fuses, which take into account cold load pickup conditions. Almost 70% of the 39 utilities responding to the questionnaire had experienced problems with cold load pickup. Present transformer and fuse sizing practices vary widely, as indicated by the fact that the 39 respondents employ at least 23 different guidelines. Only 15% of the respondents use transformer sizing guidelines that consider cold load pickup. An IBM PC computer program has been developed to determine acceptable transformer loading, including consideration of cold load pickup conditions. This program could be used, along with existing data, to produce a set of standard transformer loading guidelines. 11 refs., 8 tabs.

21 NUCLEAR POWER PLANTS

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 6059, 6060, 6061, 6063, 6066, 6068

5974 **(JAERI-M—88-129) Core burnup characteristics of high conversion light water reactor, (1). Core analyses for HCLWR-J1 (V/sub m//V/sub p/ ≅0.8).** Okumura, Keisuke; Ishiguro, Yukio; Doi, Eiji. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 72p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755514/JAW.

In order to evaluate core burnup characteristics of a high conversion light water reactor (HCLWR) with tight pitched lattice, core burnup calculation was made using two dimensional diffusion method. The volume ratio of moderator to fuel is about 0.8 in the reactor (HCLWR-J1) under study. The burnup calculations were carried out under the assumption of three batch and out-in fuel loading from the first cycle to the equilibrium cycle. A detailed evaluation was made for discharge burnup, conversion ratio, power distribution, and reactivity coefficients and so on.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 5915, 5974, 6012, 6025, 6034, 6037, 6038, 6039, 6040, 6041, 6042, 6043, 6044, 6045, 6046, 6047, 6048, 6049, 6050, 6051, 6052, 6053, 6054, 6055, 6056, 6057, 6058, 6059, 6060, 6062, 6063, 6068

5975 **(CEA-CONF—9413) In service inspection of fatigue cracks in a 1/R th scale PWR vessel with pressure cycles.** Gondard, C.; Lucia, A.; Elbaz, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 7p. (CONF-880471—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755604/JAW.

From 9. international conference on nondestructive evaluation in the nuclear industry; Tokyo, Japan (25 Apr 1988).

THE JOINT RESEARCH CENTER (JRC) at ISPRA has undertaken for several years a study on the propagation of fatigue cracks in PWR vessels. The goal is to establish a relation between the size and the location of the defects on the one hand, and the residual life of the structure on the other hand/1/. In order to verify the validity of theoretical models which were developed, a mock-up at a 1/5th scale of a PWR vessel was built. It was submitted to pressurization cycles representative of the operating conditions in a PWR. Therefore, it was necessary to have Non-Destructive methods which allows a stable and reliable track on a long period of time. This paper makes a review of results obtained by CEA during 5 successive In-Service Inspections on a 4 years period.

5976 **(CEA-DAS—482) Steam generators components inspection programme of PISC III.** Birac, C.; Herkenrath, H. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete; Commission of the European Communities, Ispra (Italy). Joint Research Centre). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 4p. (CONF-880471—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755456/JAW.

From 9. international conference on nondestructive evaluation in the nuclear industry; Tokyo, Japan (25 Apr 1988).

As a result of an enquiry conducted in 1986 and 1987 the extention of the PISC methodology has been decided for the Steam Generators Components Testing techniques evaluation. Besides calibration tubes and training tubes to be circulated amongst the participants, three phases are organized: capability tests on loose tubes, capability tests on a transportable mock-up, reliability tests on fixed mock-ups one of which has to contain interesting portions of the Surry Steam Generator. It is hoped to assess the performance and to identify clear trends for what concerns defects detection location and characterization in steam generators tubing as it has been obtained by PISC II in pressure vessel steel structures.

5977 **(CEA-DAS—493) Accident response in France.** Duco, J.; L'Homme, A.; Queniart, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 44p. (CONF-8806174—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755457/JAW.

From International approach to nuclear safety seminar; Blackpool, United Kingdom (8 Jun 1988).

French PWR power plant design relies basically on a deterministic approach. A probabilistic approach was introduced in France in the early seventies to define safety provisions against external impacts. In 1977 an overall safety objective was issued by the safety authority in terms of an upper probability limit for having unacceptable consequences. Additional measures were taken (the "H" operating procedures) to complement the automatic systems normally provided by the initial design, so as to safisfy the safety objective. The TMI-2 accident enhanced the interest in confused situations in which possible multiple equipment failure and/or unappropriate previous actions of the operators impede the implementation of any of the existing event-oriented procedures. In such situations, the objective becomes to avoid core-melt by any means available: this is the goal of the UI symptom-oriented procedure. Whenever a core-melt occurs, the radioactive releases into the environment must be compatible with the feasibility of the off-site emergency plans; that means that for some hypothetical, but still conceivable scenarios, provisions have to be made to delay and limit the consequences of the loss of the containment: the U2, U4 and U5 ultimate procedures have been elaborated for that purpose. For the case of an emergency, a nationwide organization has been set up to provide the plant operator with a redundant technical expertise, to help him save his plant or mitigate the radiological consequences of a core-melt.

5978 **(CEA-DAS—497) Research on PWR safety in France.** Zammite, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 19p. (CONF-8806283—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755458/JAW.

From IAEA technical committee meeting on thermal reactor safety research; Vienna, Austria (14 Jun 1988).

The French nuclear safety arrangements form a centralized system characterized by cooperation between the government authorities, their technical advisers and the operators of the installations, especially between the Commissariat a l'Energie Atomique (CEA) and Electricite de France (EDF). This cooperation in no way contradicts the respective responsibilities of the different parties, in particular those of EDF regarding the safety of its installations and those of CEA as the government's technical adviser and safety analyst. However, it considerably affects the research on reactor safety, which is mainly performed by the CEA Institute for Nuclear Safety and Protection (IPSN), in collaboration with EDF. For PWRs, the safety preoccupations concerning their development, commissioning and operation can be divided into the following three categories: A. Safety in design and construction, B. Safety in operation and the control of potential accidents, C. Maintaining safety - aging problems. The effort consecrated to each category has varied in the past and will continue to do so in the future. At the present stage, emphasis is being given to categories B and C. The appendix includes tables which indicate, for categories A, B and C, the relationship between the existing research programmes and the questions remaining open that they are intended to solve.

5979 (INIS-mf—11318, pp 153-162) **Concentration of WWER-1000 unit power on one site.** Rousek, J.; Kysel, J.; Sladek, V. 1987. (In Slovak). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89780020/JAW.

In Collection of the institute's papers 1986.

The problem of a suitable number of nuclear power plant units built on one site is discussed. Using an example of three sites being prepared now in Czechoslovakia, two alternatives - one with two WWER-1000 units, the other with four WWER-1000 units on one site - are evaluated from the viewpoint of long-range nuclear power development program in Czechoslovakia, costs, transmission of electric power and heat supply. (author). 10 tabs., 13 refs.

5980 **(INIS-mf—11318) Collection of the institute's papers 1986.** (Vyzkumny Ustav Palivoenergetickeho Komplexu, Prague (Czechoslovakia)). 1987. Vp. (In Slovak). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89780020/JAW.

Separate abstracts were prepared for the individual papers of this report.

5981 (INIS-mf—11320, pp 173-190) **Potential flow theory application for description of velocity distribution in WWER type reactors.** Prasser, H.M. (Ingenieurhochschule Zittau (German Democratic Republic). Sektion Kraftwerksanlagen und Energieumwandlung). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

On the basis of experimental studies carried out on a plane hydrodynamic model of WWER-440 the applicability of the potential approximation for the velocity distribution within some parts of the reactor has been investigated. Neglecting of the normal velocity component within the gap between the reactor vessel bottom and the perforated elliptical bottom of the reactor shaft and introduction of a hydrodynamic potential transforms the initial three-dimensional problem of the velocity distribution near the perforated bottom into a two-dimensional one. Such an approach combined with the method of partial solutions superposition for Laplas equation and iterations to take into account the non-linear boundary condition at the perforated bottom allow to provide an efficient and low computation time consuming technique for calculation of the velocity distribution near the perforated bottom of the WWER type reactor shaft. With this the effects of turned-off reactor loops and pressure losses in the perforated bottom can be taken into consideration as well. The experiments with a plane hydrodynamic reactor model have proved the validity of the mentioned assumptions. 6 refs.; 10 figs.

5982 **(ITEF—153(1987)) Calculation of nuclide production in the WWER reactors using the combined-iterative method and the WIMS program.** Zaritskaya, T.S.; Matveev, L.V.; Rogozhkin, V.Yu.; Rudik, A.P.; Tsenter, Eh.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704576/JAW.

A comparison of calculation results of U and Pu isotope production kinetics in WWER-440 and WWER-1000 reactors using the combined-interactive method (CIM) and the WIMS program is presented. CIM suggests the irradiation time decomposition into separate stages. At the beginning of each stage it is conducted a complete solution of space-energy problem of neutrons distribution by unit cell, determination of effective cross sections and reaction rates. Effective cross section changing kinetics is described in two-

group approximation. TRIFON-TERMIT and TOK programs are used for calaulations by CIM. In the WIMS program DSN method in 8-group approximation is accepted as the main transport method. On solution of the problem by the WIMS program, as opposed to CIM, reaction rates are suggested to be constant at each stage. The data obtained and their comparison with WWER-440 experiment indicate the coincidence of actinide concentrations within ≦0% limits. /sup 242/Pu, for which disagree is by 2 times higher, is the exception. 7 refs.; 6 figs.

5983 **(UJV—8271-R,A) Measurement of space-dependent kinetics of WWER-1000 core on LR-0 reactor.** Rypar, V.; Broulik, J.; Novak, E.; Racek, J.; Faehrmann, K.H.; Mathes, W.; Ziegenbein, D. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Jan 1988. 19p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704675/JAW.

Space-dependent response of the reactor was measured to reactivity perturbations using neutron detectors placed in the core and the reflector of the LR-0 reactor. The measuring method and the hardware and software used are described. (author). 7 figs., 5 tabs., 7 refs.

2103 Power Reactors, Non-breeding, Graphite Moderated

5984 **(KFK—4451) On the heat transfer in packed beds.** Sordon, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Sep 1988. 110p. (In German). (EUR—11391-DE). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756110/JAW.

The design of a fusion reactor blanket concept based on a bed of lithium containing ceramic pebbles or a mixture of ceramic and beryllium pebbles demands the knowledge of the effective thermal conductivity of pebble beds, including beds formed by a binary mixture of high conducting metallic pebbles and poorly conducting pebbles. In this work, binary mixtures of spheres of same diameter and different conductivities as well as beds formed by one type of spheres were investigated. The experimental apparatus consists of a stainless steel cylinder with a heating rod along the symmetry axis. Experiments with stagnant and flowing gas were performed. The pebbles were of Al/sub 2/O/sub 3/ (diameter = 1, 2, 4 mm), of Li/sub 4/SO/sub 4/ (diameter = 0.5 mm) of Al (diameter = 2 mm) and of steel (diameter = 2, 4 mm). Experimental values of the thermal conductivity and of the wall heat transfer coefficient are compared with the predicted ones. Modifications of already existing models were suggested.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 6013, 6026, 6027, 6028, 6029, 6030, 6031, 6032, 6163, 6165

5985 **(CEA-CONF—9405) Behaviour of 316 cold hammered fuel pins clusters in Phenix.** Truffert, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Mar 1988. 7p. (In French). (CONF-8803168—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755450/JAW.

From GKAE-CEA seminar; Moscow, USSR (15 Mar 1988).

The accumulated experience of 316 cold hammered steel irradiation show that their lifetime correspond to 90-100 atomic displacements. This is the swelling of this type of steel which imposes directly or indirectly by deformation mechanisms this limit.

5986 **(CEA-CONF—9443) Incidental transients problems in reactor. Application examples.** Marbach, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Mar 1988. 9p. (In French). (CONF-8803168—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755451/JAW.

From GKAE-CEA seminar; Moscow, USSR (15 Mar 1988).

The fast neutron reactor fuel element qualification should be made not only for nominal operation but also for incidental and accidental transients. Different studies and tests permit to bring this justification such as simulation in hot laboratory after irradiation of irradiated pins or specific tests interpretation.

5987 **(CEA-CONF—9471) Swelling behavior of Ti-stabilized austenitic steels used as structural materials of fissile subassemblies in Phenix.** Seran, J.L.; Touron, H.; Maillard, A.; Dubuisson, P.; Hugot, J.P.; Le Boulbin, E.; Blanchard, P.; Pelletier, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie; CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (FR); CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (FR)). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). Jun 1988. 21p. (CONF-880613—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755454/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, United States (27 Jun 1988).

In this paper we analyse the main results obained on pressurized tubes, fissile pins and hexagonal cans, allowing us to characterize the swelling and irradiation creep resistance of Ti-Mod. austenitic steels, used as reference materials for the fast breeder subassembly. After having compared the global behavior of 316Ti and 15-15Ti steels irradiated as fissile pins we examine in more detail the leading variables acting on swelling and irradiation creep resistance of CW 316Ti clads and wrappers. The irradiation creep associated to the principal mechanical stresses (sodium pressure for the wrapper, fission gas pressure for the clad) explain the plastic deformation observed on the wrappers not on the clads. Fissile pins swell more and the scatter of the results is larger than for wrappers or samples. It does not seem possible to invoque flux or primary stress differences to explain this fact. On the opposite the thermal gradient in the thickness of the components appears to be a significant parameter. In fissile pins it gives rise to a swelling gradient observed by electron microscopy that must be taken into account when comparing to the wrapper. As compared to CW 316Ti, CW 15-15Ti is an important improvement since its incubation dose for swelling is far beyond 100 dpa. Further more since it swelling temperature dependence does not seem to be as important as for 316Ti, it should be less sensitive to the effect of thermal gradients.

5988 **(CEA-CONF—9582) Incoloy 800 steam generator tubes stubbing by laser and electron beams process.** Bonnin, P.; Noel, J.P.; Gauthier, J.P.; Archer, J.; Peigney, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Dept. de Technologie; Novatome, 69 - Lyon (FR); Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 71 - Chalon-sur-Saone (FR)). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 10p. (In French). (CONF-880922—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755618/JAW.

From 4. international symposium on welding and melting by electron and laser beams; Cannes, France (26 Sep 1988).

The electron beam welding conditions are optimized for different thermal cycles and chemical compositions of the fusion zone. The metallurgical and mechanical properties of the joints are described and compared with the properties of laser and TIG welds.

5989 **(CEA-tr—2152) Measurement results and statistical treatment of deformations of hardened austenitic steel pins and hexagonal tubes in the BN-600 reactor.** Zabudko, L.M.; Kravchenko, I.N.; Meshkov, M.N.; Bibilashvili, Y.K.; Korostin, O.S.; Ogorodov, A.N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1987. 12p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755460/JAW.

Deformations of hexagonal tubes of fuel assemblies (steel 08 Cr16Ni11MZT) and pin claddings (steel 0 Cr16Ni15MZB) from the BN-600 reactor are examined after irradiation at a maximal dose of about 70 DPA. Effects of radiation dose at 430-450/sup 0/C on swelling, temperature dependence of creep, fuel can diameters are determined.

5990 **(CEA-tr—2262) USSR organization for studies on fast neutron reactor fuel pins and assemblies.** Ivanov, V.B.; Markina, V.N.; Sukhikh, A.V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1987. 9p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755625/JAW.

The works carried continuously for amelioration of fast neutron fuel pins and assemblies are based on the results of operating experience and on post irradiation studies made in metallurgical hot laboratories. The objective of this communication is to present the organization of the studies and the equipment of the metallurgical hot laboratories.

5991 **(CEA-tr—2263) Eddy current control of fast neutron reactor irradiated fuel pins.** Gorskii, V.V.; Demin, A.V.; Popov, V.K.; Fedorov, A.N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1987. 17p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755626/JAW.

In this paper the scanning mechanism, the converter block and the measuring structure of eddy current apparatus are presented. Some results of irradiated fuel pins control are given.

5992 **(CEA-tr—2264) Nondestructive controls of fuel pins used in the metallurgical laboratory hot cells.** Ivanov, V.B.; Dvoretskii, V.G.; Aleksandrov, K.A.; Kanashov, B.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1987. 10p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755627/JAW.

The metallurgical laboratory of the Scientific Research Institute on Nuclear Reactor (NIIAR) includes more than 40 hot cells and assures the solution of metallurgical problems in a large range. A leading part is made by the studies on new fuels and also by the structural studies of fuel pins with hard operating conditions or with an elevated burnup. In this communication the non destructive controls used are presented.

5993 **(CEA-tr—2265) Radiographic examination methods for fuel pins.** Smirnov, V.P.; Dvoretskii, V.G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1987. 7p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755628/JAW.

To study the fast neutron reactor fuel pins structure the NIIAR Institute used x diffraction, neutronic radiography and autoradiographies. The two first methods are used for internal macrostructure studies, the third method for the plutonium and uranium radial distribution. These methods and the main results are indicated in this document.

5994 **(CEA-tr—2273) BN-800 project: initiator events of incidents.** Vladykov, G.M.; Levshin, E.P.; Poplavskii, V.M.; Bagdasarov, Y.E.; Kuznetsov, I.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1987. 20p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755630/JAW.

The USSR nuclear reactor safety general approach is determined by the regulatory document OPB-82 General provisions to assume the reactor safety during project, building and operation. This document stipulates the elaboration of a Reactor technical safety report (TOB) in accordance with a general model. In this model, it is necessary to represent the enumeration of incidents initiator events. The analysis is made in the TOB. In this paper the enumeration of BN-800 initiator events is examined.

5995 **(CEA-tr—2279) Consequences of a double-ended severance of a steam generator tube and accidental development scenario.** Smirnov, M.V.; Titov, V.F.; Poplavskii, V.M.; Baklushin, R.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1988. 16p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755636/JAW.

The results of theoretical analysis for accidental sequences in a modular steam generator are presented. The most probable water leak development in sodium in case of steam generator emergency stop faults is examined. In all schemes the reactor safety is preserved.

5996 **(CEA-tr—2281) BN-600 agreement analysis at the regulatory guides specifications: development and application of rules, facility safety enhancement.** Saraev, O.M.; Oshkanov, N.N.; Sheinkman, A.G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1988. 14p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755638/JAW.

In this communication the BN-600 conception and operation modifications to remain in good agreement with the regulatory guides evolution are indicated.

5997 **(CEA-tr—2284) Study of cesium sharing coefficient in graphite-sodium system in relation with temperatures.** Krasnoyarov, N.V.; Polyakov, V.I.; Sobolev, A.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1987. 15p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755640/JAW.

The results of chemisorption tests of cesium on graphite made in sodium loops are presented. The sharing coefficients of cesium between carbon and sodium are determined. The temperature influence on the sharing coefficient is examined and the sharing heat is calculated.

5998 **(CONF-880532—10) Experimental and analytical studies of a passive shutdown heat removal system for advanced LMRs.** Heineman, J.; Kraimer, M.; Lottes, P.; Pedersen, D.; Stewart, R.; Tessier, J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002272/JAW.

From American Nuclear Society topical meeting; Seattle, WA, USA (1 May 1988).

A facility designed and constructed to demonstrate the viability of natural convection passive heat removal systems as a key feature of innovative LMR Shutdown Heat Removal (SHR) systems is in operation at Argonne National Laboratory (ANL). This Natural Convection Shutdown Heat Removal Test Facility (NSTF) is being used to investigate the heat transfer performance of the GE/PRISM and the RI/SAFR passive designs. This paper presents a description of the NSTF, the pretest analysis of the Radiant Reactor Vessel Auxiliary Cooling System (RVACS) in support of the GE/PRISM IFR concept, and experiment results for the RVACS simulation. Preliminary results show excellent agreement with predicted system performance.

5999 **(CONF-880911—22) Overview of advanced LMR design in the US.** Wade, D.C. (Argonne National Lab., IL (USA). Applied Physics Div.). 1988. Contract W-31109-ENG-38. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003650/JAW.

From International reactor physics conference; Jackson Hole, WY, USA (18 Sep 1988).

The current generation of US advanced LMR conceptual designs have resulted from a goal to address the economic and institutional issues facing the US nuclear industry in the late 70's and early 80's. They are focused technically on achieving passive safety characteristics and favorable capital and operating costs. The

design strategies which have been taken were motivated as well by the coal to favorably impact the institutional and public perception regimes regarding safety, diversion, nonproliferation, and waste. The rationales and tradeoffs influencing the resulting design decisions are discussed in this paper, with a focus on core design issues. 1 fig.

6000 **(DPST—87-828) Interactions of molten aluminum with water.** Hyder, M.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 13 Jan 1988. Contract AC09-76SR00001. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89002458/JAW.

Scoping calculations on the aluminum-water reaction and on the heat transfer from molten aluminum to water have been made and compared to experiments in the literature. The results are used to evaluate or set limits for possible severe accident phenomena in SRP reactors. The assumption is made that SRP fuels, which contain a few mole % uranium, can be approximated by pure aluminum. Results show that for a major steam explosion to occur, contact between the aluminum melt and water must be intimate on a scale of 0.01 cm. Chemical reaction is unlikely to add as much energy to any explosion as is derived from purely physical phenomena. Hydrogen production should be less than that required to form explosive concentrations in the reactor process room. 7 refs.

6001 **(FEI—1871) On the possibility of predicting physical characteristics of large plutonium breeder reactors on the base of experiments in simulating uranium critical assemblies and the BN-600 reactor.** Van'kov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 17p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704442/JAW.

Experimental simulation of projected fast high-power reactors with UO/sub 2/-PuO/sub 2/ mixed fuel requires a special stand and large amount of plutonium. So-called nonfull-scale simulation with plutonium inserts application or simulation with substitution of uranium with adequate enrichment for plutonium do not lead to reactor system parameters improvement. This conclusion results from statistical analysis (transfer method). However, the situation changes, if experimental data relationships of reaction microscopic cross sections and value for uranium and plutonium isotopes are introduced in this analysis. Illustrated quantitative results of planning and evaluations of simulating experiments information content under the conditions of plutonium absence within transfer method frameworks are considered. 8 refs.; 3 tabs.

6002 **(FEI—1873) Monte Carlo analysis of a test model of fast reactor shield.** Baranov, O.V.; Korobejnikov, V.V.; Savitskij, V.I.; Tsibulya, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 18p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704444/JAW.

Some usage peculiarities of Monte Carlo methods for fast reactor shield calculation are considered. The calculated analysis of one-dimensional model of fast power reactor shield by means of MMKG K and ROS-6 programs is presented. Peculiarities of walk algorithm by worth and effect of worth function different approximations on Monte Carlo calculation effectiveness were investigated. Algorithm of solution transmission from grid programs to MMKG K propgrams is described and realized. 6 refs.; 4 figs.; 9 tabs.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

6003 **(DOE/NE—0093) Important technology considerations for space nuclear power systems.** Kuspa, J.P.; Wahlquist, E.J.; Bitz, D.A. (USDOE Assistant Secretary for Nuclear Energy, Washington, DC). Mar 1988. 28p. NTIS, PC A03/MF A01. Order Number DE89004005/JAW.

This paper discusses the technology considerations that guide the development of space nuclear power sources (NPS) by the Department of Energy (DOE) to meet a wide variety of applications. The Department and its predecessor agencies have been developing NPS since the 1950s and producing NPS for spacecraft for the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) since the early 1960s. No one nuclear power type, isotope or reactor, will suffice over the entire range of mission power required. Nor is one type of power conversion system, be it static or dynamic, the optimum choice of all space nuclear power system applications. There is a need for DOE, in partnership with its users, NASA and DOD, to develop a variety of types of space nuclear power sources -- isotope-static, isotope-dynamic, reactor-static, and reactor-dynamic -- to meet mission requirements well into the next century. 2 figs., 1 tab.

2107 Regulation And Licensing

6004 **(IAEA-SR—124/8) Evaluation of Argentinian industrial capacity and of suppliers for nuclear installations.** Volman de Tanis, S. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 23p. (In Spanish). (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704468/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

This work describes and analyses the Argentinian system of purchasing, the laws and decrees which must be observed by the State enterprises and dependent bodies such as the National Atomic Energy Commission (C.N.E.A.). Within the system there are regulations which must be observed by the State suppliers, and to which the purchasing bodies must conform. Furthermore, there is a thorough analysis of the methods implemented before beginning the construction of the third nuclear plant in Argentina, the Atucha II Nuclear Plant. For this, all the existing antecedents were taken into account, insofar as they were related to the prior projects, and an exhaustive questionnaire was elaborated, in which the examined enterprises described in detail their installed capacity, their antecedents, their human resources, etc. The data thus obtained were evaluated and the task was concluded by drawing up lists of the possible enterprises to supply the most diverse components, services or equipment required both by the electrical plant and for any other large scale work. The evaluation obtained would allow an analysis of the foreign offers concerning the entire project and of the possible participation with each bidder of Argentinian industry and engineering. A description is given of the advanced method used to assess bidders with respect to such participation, to assess the replies to the questionnaire, which were analysed in detail, and the weighting factors applied to each item. Also described are some major contracts concluded with enterprises in the country. These contracts relate to the external acquisition of technology for nuclear plants and the essential points are outlined. Also analysed are the results obtained during the execution of the programmes of technology transfer and training, both for parts of different enterprises selected to produce the components, and for the State, through C.N.E.A. and ENACE S.A. 6 refs, 5 tabs.

2108 Economics

REFER ALSO TO CITATION(S) 5979, 5999, 6004, 7141, 7142, 7143, 7144, 7146, 7147, 7148, 7149, 7150, 7151, 7152

6005 **(GTS—86104) Future developments of power supply from nuclear fission and fusion until the middle of the 21st century.** (General Technology Systems (Netherlands) b.v., The Hague (Netherlands)). Mar 1987. 194p. (In Dutch, German, English). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88704447/JAW.

The purpose of this study made by General Technology Systems (Netherlands) is to provide information about nuclear fission and fusion as methods for power generation, with which, in the framework of a study into the possibilities of durable energy sources, choices may be made from the various possibilities for future energy supply. The physical processes upon which the power generation relies are treated briefly. The technologies employed are discussed together with their changes and improve-

ments, now and in the future, and the economic factors by which they are accompanied. How much of this energy will be used in the Netherlands, is discussed. In order to know the opinion of others about these subjects the dealers of the current nuclear power stations were asked to give their opinions which are collected in a supplement. 166 refs.; 18 figs.; 19 tabs.

6006 **(IAEA-SR—124/9) Promoting industrialisation.** Hayfield, F. (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 6p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704469/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

When the first nuclear power programme is decided upon, automatically the country has to initiate in parallel a programme to modify or add to its current industrial structure and resources. The extent of this new industrialisation depends upon many factors which both, the Government and the Industries have to consider. The Government has a vital role which includes the setting up of the background against which the industrial promotion should take place and in many cases may have also to play an active role all along this programme. Equally, the existing industries have an important role so as to achieve the most efficient participation in the nuclear programme. Invariably the industrial promotional programme will incur a certain degree of transfer of technology, the extent depending on the policies adopted. For this technology transfer to take place efficiently, both the donor and the receiver have to recognise each other's legitimate ambitions and fears. The transfer of technology is a process having a high human content and both donor and receiver have to take this into account. This can be further complicated when there is a difference in culture between them. Technology transfer is carried out within a contractual and organisational framework which will identify the donor (licensor) and the receiver (licensee). This framework may take various forms from a simple cooperative agreement, through a joint-venture organisation right to a standard contract between two separate entities. Each arrangement has its advantages and drawbacks and requires investment of different degrees. One of the keys to a successful industrial promotion is having it carried out in a timely fashion which will be parallel with the nuclear power programme. Experience in some countries has shown the problems when the industrialisation is out of phase with the programme whilst in other cases this industrialisation was at a level and scale unjustified.

6007 **(IAEA-SR—124/10) Role of the utility.** Bellin, A. (Electricite de France, 75 - Paris. Direction de l'Equipement). (International Atomic Energy Agency, Vienna (Austria)). Mar 1986. 32p. (In French). (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704470/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

It is common to say that a nuclear programme needs basic infrastructures such as an appropriate educational system, governmental organizations for regulation, decision and inspection, engineering organizations for design and implementation, industrial infrastructures for manufacturing, erection and commissioning, operation organizations for running and maintaining power plants. This schematic organization is not sufficient to succeed in a nuclear programme: one has to consider very carefully the attribution of responsibilities. It appears, that, among all the different systems which exist in the world for the organization of a nuclear project, it is always the utility which bears the overall responsibility for the implementation of the project. It defines objectives such as production capacity, schedule, price; it takes part in the definition of a national policy for energy supply, for the choice of a type of reactor, for the implementation of a national nuclear industry; it selects sites and conducts feasibility studies including a preliminary project; it participates in the definition of organization charts and selects contractors; it calls for and obtains authorizations from regulatory bodies; it manages the project, coordinates contractors and permanently ensures that goals are attained as regards safety, quality, schedule, costs. The French utility has directly taken charge of all these basic responsibilities and this is commonly considered as a major reason of the success of the French nuclear programme. Depending on its capacities, the utility may delegate some of these responsibilities - mainly concerning engineering and project management - to experienced firms. (Abstract Truncated)

6008 **(IAEA-SR—124/12) Experience of improving quality assurance in the Brazilian industry.** Syllus, C. (NUCLEN, Rio de Janeiro (Brazil)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 15p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704472/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

The growing participation of local engineering companies and industry in nuclear power plant implementation programs is highly important to developing countries which have decided for such programs. This participation is quite necessary and important on a political, economic and operational basis. Politically, two aspects should be taken into account; firstly, no country should develop a large and unforeseable dependence upon foreign sources for its power supply, and secondly, services and supplies which can be provided locally should not be purchased abroad. Regarding to the economic aspects, it would be very difficult to import complete nuclear power plants, taking into account the limited foreign currency unavailability to the country. As for the plant operation, if one considers the need for maintenance and repair throughout plants service life time, it would not be wise to have to fall back on foreign supply whenever a problem arises in a plant. This paper deals only with local industry participation in the construction of nuclear power plants. The first and foremost actions to be taken toward such participation should be identifying those industrial companies which have potential qualifications to participate in the construction program, and detecting the difficulties and shortcomings which must be overcome for the qualification of the various industrial companies. The difficulties for local industry participation are mainly of economic and technical nature. Economic difficulties refer to economy of scale and the amount of investments to be made by the industry in order to become qualified to participate in the program. These issues are connected with the cost of equipment to be manufactured and therefore with plant cost. As regards to the technical difficulties to be faced one has to consider the know-how for technical specifications and standards, product engineering, manufacturing procedures and above all quality assurance. (Abstract Truncated)

6009 **(IAEA-SR—124/18) Way to achieve independence in China's nuclear power development.** Lian Peisheng. (Ministry of Nuclear Industry, Beijing (China)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 13p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704477/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

Very much in need of developing nuclear power, China has found the main problem to be shortage of funds, particularly that of foreign currency. The only way to overcome this difficulty is to increase national share to the utmost extent. Since engineering and management of such complex and capital-intensive projects as NPPs has very important bearing on promoting national participation, much emphasis is placed on acquirement of software technology. Technology transfer is therefore sought in light of this need as well as of China's specific conditions.

6010 **(IAEA-TECDOC—470) Energy and electricity demand forecasting for nuclear power planning in developing countries. A reference book.** (International Atomic Energy Agency, Vienna (Austria)). Jul 1988. 327p. NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS. Order Number DE88704955/JAW.

This Guidebook is designed to be a reference document to forecast energy and electricity demand. It presents concepts and methodologies that have been developed to make an analytical approach to energy/electricity demand forecasting as part of the planning process. The Guidebook is divided into 6 main chapters:

(Energy demand and development, energy demand analysis, electric load curve analysis, energy and electricity demand forecasting, energy and electricity demand forecasting tools used in various organizations, IAEA methodologies for energy and electricity demand forecasting) and 3 appendices (experience with case studies carried out by the IAEA, reference technical data, reference economic data). A bibliography and a glossary complete the Guidebook. Refs, figs and tabs.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 6005

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 6706

6011 **(EUR-CEA-FC—1347) Ignition in net for different energy confinement time scalings.** Johner, J.; Prevot, F. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jun 1988. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756125/JAW.

A zero-dimensional profile dependent model is used to assess the feasibility of ignition in the extended version of NET. Five recent scalings for the energy confinement time (Goldston, Kaye All, Kaye Big, Shimomura-Odajima, Rebut-Lallia) are compared in the frame of two different scenarii, i.e., H-mode with a flat density profile or L-mode with a peaked density profile. For the flat density H-mode case, ignition is accessible with none of the scalings except Rebut-Lallia's. For the peaked density L-mode case, ignition is accessible with none of the scalings except Rebut-Lallia's. For the two Kaye's scalings, ignition is forbidden in H-mode even with the peaked density profile. For the Rebut-Lallia scaling, ignition is allowed in L-mode even with the flat density profile.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 5875, 6000

6012 (INIS-mf—11320, pp 246-253) **Plane nozzle and ejector as elements of a bubbling system for pressure reduction in water cooled reactors.** Gerchev, S.; Pavlov, V.; Stoyanov, S. 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

There are known systems for pressure reduction in the hermetic premises of the water cooled reactor primary circuit. They usually include bundles of tubes with circular cross-section placed under a layer of water. A new technical solution is suggested: the outlet end of the bubbling tube is transformed into a plane nozzle to which a plane channel with confuser and diffuser can be attached. Method of testing has been developed and an experimental facility constructed to test the device in the pilot-plant scale. The experiments were carried out at 100-160 grad.C of the steam and steam-air mixture. Pressure at the bubbling element inlet were varied within 1.2-1.8 bar. With the presence of the plane nozzle and plane channel at the tube end the bubbling and condensation process modes were much quieter. The new technical solution can be useful for the bubbling tubes of a greater diameter located under a thinner layer of water in the bubbling volume. 4 refs.; 3 figs.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 6215, 6288, 6293

6013 **(CEA-tr—2266) Fuel pins volume measuring installation in hot cells.** Prokudanov, D.L.; Troitskii, S.V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Nov 1987. 6p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755629/JAW.

The NIIAR Institute has elaborated a method and concepted an installation for determining precisely the fuel pin volume. This determination is based on a fluid measurement level by ultrason. The operation principle and the installation diagram are indicated in this document.

6014 **(ECN—208) Comparative testing of instrumented sphere-pac and pellet UO/sub 2/ fuel rods up to rod average burnups of 44 MWd/kg UO/sub 2/ in the Halden Boiling Water Reactor.** Linde, A. van der. (Netherlands Energy Research Foundation, Petten). Jun 1988. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704418/JAW.

Comparative testing during almost eleven years of sphere-pac and pellet UO/sub 2/ fuel in instrumented, 1.7 m long, fuel rods has been performed in the Halden Boiling Water Reactor, HBWR. Four sphere-pac and three pellet UO/sub 2/ rods were assembled in the IFA-416 bundle and achieved maximum rod average powers and burnups of respectively 46 kW/m and 44 MWd/kg UO/sub 2/. Two sphere-pac and two pellet rods were instrumented with detectors for fuel column and cladding elongation. Post-irradiation examination has been performed at IFE in Kjeller and comprised dimension measurements, gamma scanning, puncturing and microscopy on transverse rod sections. On the basis of measured curves of rod elongation/rod average power an expression has been developed which relates local fuel cladding mechanical interaction, FCMI, induced cladding elongation, in %, with local linear power, in kW/m. The percentage fission gas release and the extent of fuel restructuring were much larger in the sphere-pac rods than in the comparable pellet rods. This was due to the much smaller thermal conductivity of the unrestructured outer regions of the sphere-pac UO/sub 2/ column than that of pellet UO/sub 2/. A threshold power of approximately 50 kW/m was found beyond which a breakthrough of radial cesium transport from sintered centre towards inner cladding surface occurs in the sphere-pac rods. The overall conclusion of the comparative testing is that under normal LWR conditions the in-reactor behaviour of sphere-pac UO/sub 2/ is practically similar to that of pellet UO/sub 2/ but under power ramping conditions beyond 50 kW/m sphere-pac UO/sub 2/ is inferior to pellet UO/sub 2/. 16 figs.; 11 refs.; 10 tabs.

6015 (INIS-SU—61/A, pp 46-48) **Software development assurance for special control computer sets on the base of the Electronica-60M microcomputer in the stations of fuel element nondestructive testing.** Vasil'kova, A.D.; Grachev, S.N.; Salakatova, L.S. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

A special computational control complex (SCCC) including the "Elektronika-60M" microcomputer, a device for communication with an object (DCO) based on the typical microprocessing set (TMS) based on LIUS-2 KTS means and an adapter for communication of the "Elektronika-60M" microcomputer bus with IK1 TMS bus developed for their conjugation is used for development of nondestructive control post software. An instrumental SCCC including SM-4 microcomputer, TMS units as DCO, an adapter for communication of the common bus of the SM-4 minicomputer with the IK1 TMS bus developed for their conjugation and devices for simulation of the facility operation is suggested to increase labour productivity of programmers. The SM-4 microcomputer permits to develop programs in the FORTRAN language and to carry out their effective adjustment. A subprogram library for communication with TMS units is compiled, and the technique for testing FOR-

TRAN programs in programmable read-only memory TMS as well as start of these programs are developed. 2 refs.

6016 (INIS-SU—61/A, pp 49-51) **Metrological support of fuel cladding geometric parameter testing.** Ivanov, V.B.; Inchagov, A.V.; Dvoretskij, V.G. and others. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).

In Radiation technique. Scientific-technical collection.

Problems of development and testing means of metrological software for nondestructive control methods of geometrical parameters of experimental fuel cladding are considered. Procedures of their application in calibration of measuring systems of the external diameter and wall thickness of cladding tubes are shown. 4 figs.

2204 Control Systems

REFER ALSO TO CITATION(S) 6035, 6062, 6063

6017 (CEA-DAS—492) **OST: analysis tool for real time software by simulation of material and software environments.** Boulc'h; Le Meur; Lapassat; Salichon; Segalard. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire). (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 10p. (In French). (CONF-8806287—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755623/JAW.

From Meeting on electronic systems safety; Grenoble, France (9 Jun 1988).

The utilization of microprocessors systems in a nuclear installation control oblige a great operation safety in the installation operation and in the environment protection. For the safety analysis of these installations the Institute of Protection and Nuclear Safety (IPSN) will dispose tools which permit to make controls during all the life of the software. The simulation and test tool (OST) which have been created is completely made by softwares. It is used on VAX calculators and can be easily transportable on other calculators.

6018 (INIS-BR—1283) **Nuclear instrumentation for the critical unity of IPEN.** Mello, H.A. de. (Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)). [1988]. 10p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704526/JAW.

The nuclear instrumentation for the critical assembly of IPEN, which was constructed for monitoring neutron flux, is described. (M.C.K.).

6019 (INIS-BR—1304) **Computer systems for nuclear installation data control.** (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ. Dept. de Instalacoes e Materiais Nucleares). Sep 1987. 143p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88704543/JAW.

The computer programs developed by Divisao de Instalacoes Nucleares (DIN) from Brazilian CNEN for data control on nuclear installations in Brazil are presented. The following computer programs are described: control of registered companies, control of industrial sources, irradiators and monitors; control of liable person; control of industry irregularities; for elaborating credence tests; for shielding analysis; control of waste refuge.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 7163

6020 (ISH—106) **Measurement of nitrogen-16 radiation in the vicinity of nuclear power plants in the Federal Republic of Germany.** Winkelmann, I.; Vogl, K. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene; Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)). Feb 1987. 101p. (In German). Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

Source and type of the radiation are described. A scintillation dosemeter, an argon high pressure ionization chamber and a γ-spectrometric system with both a NaI(Tl) detector and a semiconductor detector were used. The evaluation of the dose rate from the measured spectra is described as well as the calibration of the various measuring systems. The results of measurements in the vicinity of Brunsbuettel, Isar unit 1, Kruemmel, Philippsburg unit 1, Gundremmingen and Wuergassen, all BWRs are given as well as results of measurements in the vicinity of the Biblis reactor (PWR). The measured dose rates differed for the various nuclear power plants. All values were below the limits given in the German Radiation Protection Ordinance. At Biblis no N-16 radiation could be detected, not even close to the reactor. As expected, this was due to intensive shielding of the N-16 radiation source. Additional measurements of dose rate and integrated dose respectively were performed at Kruemmel using TLD. The results show that the TLD-technique is a suitable and reliable method for measuring doses due to N-16.

6021 (PNL-SA—15774) **Diffusion in building wakes.** Ramsdell, J.V. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1988. Contract AC06-76RL01830. 7p. (CONF-880913—7). NTIS, PC A02/MF A01 - OSTI. Order Number DE89001748/JAW.

From ANS topical meeting on emergency response: planning, technologies and implementations; Charleston, SC, USA (26 Sep 1988).

Straight-line Gaussian models adequately describe atmospheric diffusion for many applications. They have been modified for use in estimating diffusion in building wakes by adding terms that include projected building area and by redefining the diffusion coefficients so that the coefficients have minimum values that are related to building dimensions. In a recent study, Ramsdell reviewed the building-wake dispersion models used by the Nuclear Regulatory Commission (NRC) in its control room habitability assessments. The review included comparison of model estimates of centerline concentrations with concentrations observed in experiments at seven nuclear reactors. In general, the models are conservative in that they tend to predict concentrations that are greater than those actually observed. However, the models show little skill in accounting for variations in the observed concentrations. Subsequently, the experimental data and multiples linear regression techniques have been used to develop a new building wake diffusion model. This paper describes the new building wake model and compares it with other models. 8 refs., 2 figs.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 5867, 6014, 6064, 6382

6022 (JAERI-M—88-112) **Energy deposition in NSRR silicide fuels.** Soyama, Kazuhiko; Onishi, Nobuaki. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jun 1988. 37p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755510/JAW.

The energy deposition in NSRR U/sub 3/Si/sub 2/-Al fuel plates has been evaluated in this report. It was assumed that one test plate was irradiated transiently in NSRR experiment hole. The uranium density in the fuel meet ranged between 2.15 gU/cm/sup 3/ and 5.01 gU/cm/sup 3/. The length of fuel plate ranged be-

tween 10.0 cm and 20.0 cm. The average energy deposition in the fuel plate which uranium density is 5.01 gU/cm/sup 3/ and fuel length is 15.0 cm, is 548.6 cal/g/100 MW/sec. The melting point of U/sub 3/Si/sub 2/ is 1938 K. The test plate is melt at the energy deposition which is 225.4 cal/g (density 12.2 g), so the test plate will be melt by NSRR experiment. According to increase in uranium density, the average energy deposition in unit volume increase, but that in unit mass dicrease. The energy deposition distribution is rose up at the top and bottom of the test plate, and it is flat at the center of it.

6023 **(JAERI-M—88-142) Study for thermal mixing of coolant in a core-bottom structure of HTTR, 1. With mixing promoter.** Inagaki, Yoshiyuki; Kunugi, Tomoaki; Miyamoto, Yoshiaki. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 28p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755520/JAW.

The numerical and experimental studies were conducted to clarify the thermal mixing performance of a coolant in the core-bottom structure of HTTR (High Temperature engineering Test Reactor) being developed in JAERI. The experimental study was carried out using a one-seventh scale model of the core-bottom structure and water as testing fluid. The experimental conditions were as follows: the temperature differences between hot and cold water at the inlet of the test section were 20 {similar←to}40 deg C, and Reynolds number calculated with the diameter of the outlet nozzle was 40,000 {similar←to}100,000. The numerical study was made using a three dimensional time-dependent flow and heat transfer code named STREAM. In order to evaluate the validity of the STREAM code, the numerical results were compared with the experimental ones. The both results were in good agreement and it was confirmed that the STREAM code was able to use the prediction of the thermal mixing in the core-bottom structure of HTTR.

6024 (KEK—87-26, pp 36-39) **Beam of cold neutron source for KUR.** Utsuro, Masahiko. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Jan 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780028/JAW. (CONF-8711247—).

From 1. workshop on the neutron lifetime; Oho, Japan (19 Nov 1987).

The cold neutrons having energy less than about 5 meV fly slowly as compared with thermal neutrons (average energy: about 25 meV), and the time required for flying a certain distance becomes long, accordingly they are advantageous for the measurement of the decay life of neutrons and the experiment on the phenomena accompanying decay. However, the proportion of cold neutrons in the beam directly taken out from the core of a research reactor is usually as small as several %, consequently, in order to utilize the merit of cold neutrons, the equipment for generating large quantity of cold neutrons by converting thermal neutrons to cold neutrons is necessary. At present, most of beam experiments are carried out by using neutrons at the exit of neutron ducts, and neutron beam width can be taken wide easily, but the diverging angle of neutron beam becomes large. A liquid heavy hydrogen type cold neutron source was installed to the research reactor (KUR) in Research Reactor Institute, Kyoto University, as the three-year project from fiscal year 1984. The supply of cold neutron beam is begun in March, 1988. The outline of the cold neutron source, its beam characteristics and the cold neutron beam density in a neutron life experiment are reported. (Kako, I.).

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 6033

2209 Reactor Safety

REFER ALSO TO CITATION(S) 5981, 5995, 6000

6025 **(CEA-CONF—9470) TMI-2 core materials examinations at CEA.** Duco, J.; Trotabas, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). Oct 1988. 3p. (CONF-881024—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755609/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

6026 **(CEA-tr—2274) Accidental situations analysis in the BN-800 core.** Buksha, Y.K.; Bagdasarov, Y.E.; Kuznetsov, I.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1987. 15p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755631/JAW.

In this report localized and genelarized pertubations basis events, inducing deviations in the fuel assemblies normal operation, are analyzed.

6027 **(CEA-tr—2275) Accidental situations analysis in BN-800 reactor bounded with an untimely ascension of the control rods.** Gorbunov, V.S.; Zaets, N.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1987. 17p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755632/JAW.

In this document the conditions and the results of one or more control rods untimely ascension out of the BN-800 core are examined. The mathematical model which describes the reactor kinetic, the temperature core and the feedback is presented.

6028 **(CEA-tr—2276) Evaluation of BOR-60 operation safety.** Minakov, A.A.; Antipin, G.K.; Efimov, V.N.; Kuzin, G.G.; Eschenko, L.V.; Eschenko, S.N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1987. 16p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755633/JAW.

In this communication, BOR-60 reactor operation anomalies capable to produce a dangerous overheating of the core (SDC) is examined. On bases of calculations and reactor operation experience an event tree for SDC is built. Evaluations of probable anomalies entering in the event tree and reactor parameters modifications in case of anomalies are presented. In conclusion BOR-60 agree with the sovietic nuclear safety.

6029 **(CEA-tr—2277) Development way analysis and accidents probability evaluation in case of failure apposition in the BN-800 emergency heat removal system.** Frolov, E.V.; Makeev, Y.A; Zaets, N.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Dec 1987. 25p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755634/JAW.

In this document the regulatory guide (OPB-82) particular requirements for fast neutron reactor safety systems are examined. A classification of the initial events for the BN-800 reactor is realized. The safety systems construction project is examined. The results of deterministic analysis of the structure and the efficiency of the emergency heat removal system in case of earthquake is presented.

6030 **(CEA-tr—2278) Maximum for seeable accident analysis made by a sodium leak on the BN-800 primary circuit and the more constraining accident development scenario.** Ivanenko, V.N.; Zybin, V.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1988. 21p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755635/JAW.

In this paper the different ways of development for the BN-800 maximum credible accident in case of loss and fire of primary sodium are examined. The more constraining scenario is presented. During the scenario analysis the accidental release of radioactive materials in the environment has been studied. These releases are below the authorized values.

6031 **(CEA-tr—2280) Seismic effects in BN-800 building project.** Ivanov, V.A.; Matsepura, R.P.; Chikunova, T.N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1988. 21p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755637/JAW.

The taking in account of earthquakes in the BN-800 building project in accordance with the seismic accelerograms used in USSR is given in this document.

6032 **(CEA-tr—2282) Evolution of BN-350 of residual power emergency removal system.** Antuf'ev, O.N.; Bagdasarov, Y.E.; Bolgarin, V.I; Buksha, Y.K. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1988. 25p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755639/JAW.

In this communication the initial events of accidents and the BN-350 residual power emergency removal system are described. The conditions involving an enlargement of the initial events enumeration and the emergency removal system failures are indicated. This enlargement has conducted a modernization and a refitting of the residual power emergency removal control subsystems. On the basis of operation return and experimental datas, the utilization of Nadezhnost steam generators give the best perspective for residual power evacuation in case of accident.

6033 **(DPST—87-511) Axial power profiles in SRP reactors during LOCA.** Pevey, R.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 26 Jun 1987. Contract AC09-76SR00001. 36p. NTIS, PC A03 - OSTI. Order Number DE89003447/JAW.

Detailed analysis of the consequences of a large-break LOCA requires knowledge of the deposited power distribution in each assembly of the core. The deposited power distribution in an assembly can be considered to consist of radial, axial, and time-dependent components. The radial power distribution can be determined from the GLASS lattice calculations; the total deposition rate following scram can be determined using standard reactor kinetics models. This study was undertaken to determine the third component - the axial power shapes following a LOCA-induced scram. Since falling safety rods distort the axial power shape, a one-dimensional transient diffusion theory code was written and applied to the standard beginning-of-life Mark 22 and Mark 16-31A clusters. The results show that the pre- and post-scram axial power profiles are flattened cosines with a maximum/average ratio of about 1.4, but that during the scram, the falling rods cause the power profiles to distort. At the maximum distortion, occurring when the rods have fallen half way into the core, the maximum/average power ratio has increased to almost 1.6 and the peak of the profile occurs 3/4ths of the way down the active length (i.e., at about 750 veeder units insertion.) 1 ref., 6 figs., 2 tabs.

6034 **(ENEA-RT-TIB—88-4) Thermo mechanical benchmark calculation of a hexagonal can in the BTI accident with INCA code.** Zucchini, A. (ENEA, Bologna (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704435/JAW.

The thermomechanical behaviour of an hexagonal can in a benchmark problem (simulating the conditions of a BTI accident in a fuel assembly) is examined by means of the INCA code and the results systematically compared with those of ADINA.

6035 **(GRS-A—847) Calculation of reliability and safety characteristics of the hardware of periodically inspected, single-channel automation equipment.** Ploegert, K.P. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Jul 1983. 40p. (In German). NTIS, PC Exx; Available from NTIS as TIB.

In fields of application of low or medium safety relevance, automation equipment can be made single-channeled, i.e. non-redundant, but even at reduced safety requirements, the equipment must not become a hazard to the environment in case of failure. This safety level must be achieved by engineering and design means, and has to be tested and verified. For this purpose, the safety relevance of the various applications is broken down into safety classes or levels, and each safety level is defined in terms of characteristics of safety, with models being given to assist the calculation of the characteristics. The specific problems encountered with single-channel hard-ware are explained, along with the relevant solutions. Formulas are given that allow to take into account the effect of several, overlapping fault detection mechanisms with different detection efficiencies. As to the theoretical proof, a scheme is set out for saving analysing work in the determination of calculation parameters. Examples explain the calculation of safety and reliability characteristics, and how the same safety level can be achieved with different, given inherent reliability of equipment.

6036 (INIS-mf—11318, pp 80-85) **Results of IAEA scientific research project "Power system risk reduction" and contribution of VUPEK studies to its solution.** Horacek, P.; Razga, J.; Kadlec, J. 1987. (In Czech). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89780020/JAW.

In Collection of the institute's papers 1986.

Results are summarized of the research program co-ordinated by the International Atomic Energy Agency "Comparison of cost effectiveness of reduction of risks" achieved by May, 1986. Altogether 19 case studies were performed within the program. Main attention is concentrated to case studies performed by the VUPEK (Research Institute of the Fuel and Energy Complex). The results of the studies demonstrate a broad applicability of the method in evaluating cost effectiveness of the reduction of risks in various fields of power research and as a practical tool in decision making in risk control. (author). 7 refs.

6037 (INIS-mf—11320, pp 1-15) **Analysis of computation models for determining the coolant pressure during LOCA.** Suchanek, M. (Statni Vyzkumny Ustav pro Stavbu Stroju, Bechovice (Czechoslovakia)). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Experiments have been carried out with hot water discharge flow from a high pressure vessel. Comparison of various discharge flow models (a homogenious model, Mudi's model, Henry-Fauske model) with the experimental study of non-stationary critical flow through 10mm diameter orifice has demonstrated similar accuracy of the process description at the first stage when the level of the steam/water mixture oscilates above the orifice. At the following stages considerable description diversion is revealed. A new model has been developed for more adequate description of later stages of the process, providing a direct output parameters dependence on the initial conditions. 5 refs.; 1 tab.; 6 figs.

6038 (INIS-mf—11320, pp 16-29) **Computerized modelling of experiments with simulation of the NPP primary circuit coolant discharge flow.** Myunkh, V.; Kyuks, B.; Karl, K.; Kirshner, A. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Technische Univ., Dresden (German Democratic Republic)). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

RAMPA computer code for thermal-hydraulic analysis of an accidental coolant discharge flow from the primary circuit of a NPP with WWER type reactor is described. The computation results have been compared with the experimental data obtained at 'HOVAN' test facility. Some corrections for RAMPA code to improve the agreement between the calculation and experimental results are discussed. 6 refs.; 7 figs.

6039 (INIS-mf—11320, pp 30-42) **Role of natural circulation during LOCA (small leakage) at W312 PWR.** Khinovski, I. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Issues of the coolant natural circulation in 1000MW reactor core during LOCA (with small leakage) considered. The process is described in terms of three quasi-stationary states: one-phase natural circulation and natural circulation with condensation in reversed flow. Disagreements between the experimental data and the results obtained with RELAP 4 (model 6) code are discussed. 1 ref.; 10 figs.

6040 (INIS-mf—11320, pp 43-55) **SLAP code for analysis of small and intermediate coolant leakages in WWER type reactors.** Misak, J. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

A simplified multicomponent computation code has been suggested for the analysis of small/intermediate coolant leakages in WWER type reactors. As compared with the 'classic' codes the following additional assumptions were made: thermodynamic pressures in all the components are equal and the coolant inertia within the connecting pipes can be neglected. The calculation scheme includes 20 components and 20 connecting pipes. The code was written in FORTRAN language and required 194 kBight in the computer memory. The code has been tested within the range of leakage diameter from 13 to 120mm. 6 refs.; 6 figs.

6041 (INIS-mf—11320, pp 69-88) **PMK-NVH experimental device for investigation of processes in NPP with WWER-440 primary coolant circuit.** Sabadosh, L.; Maroti, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Short description of PMK-NVH experimental device imitating NPP in Paks is given. The model scale with respect to the thermal power and volume is 1:2070. The reactor core is simulated by a 19 rods claster. The device control and data acquisition are totally computerized. Detailed programme for experiments with leakages both in stationary and transition regimes is presented. Comparative analysis has been performed of actual leakages in Paks NPP reactor and those in the experimental device. The results divergence is discussed. 5 refs.; 3 tabs.; 9 figs.

6042 (INIS-mf—11320, pp 89) **Investigation of WWER-440 core behaviour during LOCA.** Klyugel', E.-U.; Myunkh, V.; Rumpf, J. 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Thermal-hydraulic and mechanical response of WWER-440 core to a rapture of the 'cold' end of the main circulation pipeline has been investigated. According to the results of thermal-hydraulic analysis performed with KHAPRID and ESSM codes the fuel cladding temperature won't exceed the permissible limit. On the basis of thermal-hydraulic analysis the mechanical behaviour of the fuel cladding has been studied up to the possible distruction.

6043 (INIS-mf—11320, pp 90-94) **On the feasibility of WWER-1000 MAXIMUM DESIGN CONTAINMENT PRESSURE REDUCTION.** Kolev, N.I. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

A study has been carried out to reveal how far can the pressure in NPP with WWER-1000 containment be reduced during an accident with the main coolant pipeline rupture with the use of a bubbler. 60000 m/sup 3/ air volume has been considered devided into a dry and wet plenum. These plenums are communicated through a vertical annular channel connected with three vertical pipes of 0.5m diameter and 1.5m length located in one plane. The calculations were performed with KONTEMPT LT 26 code. 3 refs.; 4 figs.

6044 (INIS-mf—11320, pp 95-110) **Processes in the NPP with WWER-1000 CONTAINMENT DURING LOCA.** Kolev, N.I. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

The results of a numerical modelling of the processes in the NPP with WWER-1000 containment during an accident with the main coolant pipeline cold branch rupture in the immediate vicinity of the reactor are presented. The calculations were performed with KONTEMPT-LT 26 code. An analysis of LOCA has been carried out for a 60000 m/sup 3/ containment volume from the nuclear safety viewpoint. A hypothetical situation was considered when partial or total reactor core destruction took place due to an operator error. 6 refs.; 18 figs.

6045 (INIS-mf—11320, pp 111-116) **NPP with WWER-1000 containment performance during an accident with the break in a windpipe between the compensating volume and main coolant pipeline.** Kolev, N.I. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

The results of a numerical modelling of the processes in the NPP with WWER-1000 containment during an accident with the rapture of a tube connecting the compensating volume with the primary circuit are presented. The initial and boundary conditions data were taken from the experimental studies results published earlier. The calculations have shown that maximum liquid temperature (312 K) within the containment is reached in 75 s after the accident start-up, while the maximum thermal load to the wall occurs at 405 s. 5 refs.; 8 figs.

6046 (INIS-mf—11320, pp 117-141) **Calculation models for the fuel element cladding behaviour during LOCA.** Buyan, A.; Adamik, V. 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Two calculation models, RUPTUR and DEFOR, are described that were developed for the mechanical stress analysis of the WWER fuel element cladding during a major LOCA. For the calculations two constant gas pressure levels (2.7 MPa and 1.5 MPa) under the fuel cladding were assumed. The calculation results are compared with experimental data and possible sources of disagreement discussed. 12 refs.; 1 tab.; 9 figs.

6047 (INIS-mf—11320, pp 142-153) **Analysis of the expansion wave driving parameters at a quick pressure discharge.** Bartak, J. (Statni Vyzkumny Ustav pro Stavbu Stroju, Bechovice (Czechoslovakia)). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Experimental results are presented that have been obtained from the study of expansion waves formation and propagation in a horizontal channel imitating the inlet pipe with a portion of the nuclear reactor primary circuit pipeline. The expansion wave character has been shown to depend on the initial coolant temperature (240-300 grad.C), the speed of pressure discharge, the initial pressure level (8-12 MPa) and the break location relative the reactor vessel. Semi-empirical dependences have been suggested for calculation of the expansion wave amplitude. 7 refs.; 1 tab.; 4 figs.

6048 (INIS-mf—11320, pp 154-164) **Stress and strain analysis of B 213-Ch reactor shaft during LOCA.** Pechinka, L.; Chekhura, M. 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

An accident with the reactor inlet pipeline break has been analyzed when at the start of the process the internal pressure gradient affects only a small area in the vicinity of the broken pipeline. A set of equations is presented together with the adopted assumptions. Good agreement between the calculation results and the experimental data obtained from GIIM test facility has been demonstrated. 4 figs.

6049 (INIS-mf—11320, pp 165-172) **Mathematical model of a shock wave born at the reactor pipeline break.** Volkov, G.A.; Krasnov, S.N.; Rubanov, A.V.; Spasskov, V.P. 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

A mathematical model has been suggested to describe the shock wave formed during an instantaneous break of the reactor pipeline and discharge of hot pressurized coolant into the reactor environment. The model differs from the traditional ones by elimination of the restrictions connected with the assumption of constant pressure and coolant flow rate at such a break. The model is realized in UDAR code on BEhSM-6 computer. 2 refs.; 2 figs.

6050 (INIS-mf—11320, pp 191-206) **Non-equilibrium thermodynamic model for transition processes in the containment during accidents with the primary circuit coolant leakage.** Cerny, J. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

A short description of HEPRO 2 code is presented. The code is designed to calculate the pressure and temperature of steam-air mixture within various protective premises (containments, hermetic premises) during LOCA. The spacial distribution of the main parameters are taken into account by means of dividing the total considered volume into a certain number of zones. With this both thermodynamic equilibrium and non-equilibium process models can be used. The analysis begins from the moment of the accident start-up and ends with the achieving of a reduced pressure within the premises after putting into action a spray system. As an example an analysis is presented for an accident with major reactor pipeline cold leg breaking within a hermetic premises with the WWER-440 type bubbling system. 4 refs.; 8 figs.

6051 (INIS-mf—11320, pp 207-216) **RAUDI code for calculations of transition processes in WWER type reactors.** Krell, I.; Majer, A.; Shenehkk, M. 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

RAUDI code has been developed for studying the WWER type reactor core behaviour with the presence of parameter deviations from nominal or some changes in the reactor and during small accidents (excepting LOCA). The code provides a selfconsistent solution of three-dimensional neutronic-kinetic equations (to determine the power density distribution over the core) and a system of thermal-hydraulic equations (to describe the feedback). Each fuel rod bundle is considered as an independent channel with no cross-flow mixing with other channels. The following disturbances can be investigated: the control bundles moving; boric acid concentration variations; the core inlet temperature variations; the pressure drop across the core variations; changes of the local pressure loss coefficient at the core inlet; pressure variations in the primary circuit. An example of calculation is given for an experiment with the control rods drop in WWER-440. The obtained results show some pronounced spacial effects that usually hinder the experimental data analysis. 3 refs.; 5 figs.

6052 (INIS-mf—11320, pp 217-245) **Thermochemical analysis of WWER type reactor fuel elements during MDA.** Boyadzhiev, A.I.; Totev, T.L.; Stefanova, S.J. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

For the first time the analysis results of the processes in fuel elements are presented for all three MDA stages (break flow, lower plenum filling, core reflooding from the emergency cooling system), considered time interval is O-200s. The impact of some major initial parameters on the fuel rod cladding temperature and strains during MDA has been investigated. To define the initial conditions including the state of the primary circuit and reactor core RELAP 4/Mod 6 codes were used. The processes in the fuel rods were calculated by SSYST-2 code combined with the first two into a single complex. The following factors were investigated: fuel power density, initial gas pressure under the cladding, design tolerances, fuel burnup. It is pointed out that the described code complex is suitable for the thermomechanical analysis of the WWER-1000 fuel rods and provides reliable results. 12 refs.; 3 tabs.; 17 figs.

6053 (INIS-mf—11320, pp 254-262) **Experimental study of heat transfer under the conditions of WWER type reactor emergency cooling.** Kotrnokh, J.; Blaga, V.; Jukl, M.; Nikonov, S.P. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Experimental data are presented that were obtained from the study of a seven-rod model fuel bundle reflooding. The experimental section consisted of 1X18H9T stainless steel tubes with 9 mm diameter, 0.5 mm wall thickness and 2.5 m heated length. the tubes were heated by direct electric current. The model was placed into a quartz tube, the tubes spaced by means of grids 0.3 mm thick and of 10 mm height, with the distance between them of 240 mm. The bundle was heated till achieving a steady-state regime at the thermal loads of 3, 6, 10 kW/m/sup 2/. The surface temperature was 400, 500, 600 grad.C respectively. The stationary state being established, the water was fed into the section via an electromagnetic valve. According to the obtained results for the given geometry within 40-80 kg/m/sup 2/s interval of the mass flow rate there is a boundary where the major factors governing the process are hydrodynamic relations. The front acceleration in the lower part resulted from the enhanced steam generation that stimulated the droplet carry-over and consequently a better cooling of the heated surface. In the flow within the bundle as a whole a steam core was formed near the central rod while on the glass tube wall a liquid film appeared. These phenomena resulted in the front deceleration at the end of the central rod. 6 refs.; 2 figs.

6054 (INIS-mf—11320, pp 263-270) **Data processing technique for experiments with reactor reflooding simulation.** Jukl, M.; Blaga, V.; Nikonov, S.P. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Experimental data processing issues are considered with regard for the investigations carried out on test facilities for the peactor core emergency cooling study. The following parameters are measured during the experiments: coolant inlet/outlet pressure and temperature, the velocity at the experimental section inlet, the electric current and voltage in the simulator. Information on the cooling front behaviour is obtained from thermocouples located at five height levels. To produce a uniform time dependence the interpolation method (or approximation at non-zero errors) by cubic splines has been used. The data processing is realized on ADT-4100 computer at Skoda.

6055 (INIS-mf—11320, pp 271-288) **Thermohydraulic parameters variation study during simulation of LOCA.** Baran, V. 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

The results of the coolant thermal-hydraulic parameter variations study during imitation of the WWER LOCA are presented. The experiments were conducted on VIV-300 facility (p=15 MPa, t=330 grad.C), with an additional device the pipe breaking imitation (two double-membrane systems) at the parameters specific for WWER-440 (p=12.5 MPa, t=300 grad.C). During the experiments variations of the coolant pressure and temperature were registered at the break point. The parameter variations are presented on graphs. 5 refs.; 5 figs.

6056 (INIS-mf—11320, pp 56-68) **Experience of small/intermediate coolant leakage simulation for WWER-440 reactor.** Misak, J.; Bazho, Z.; Klepach, Yu. (Vyskumny Ustav Jadrovych Elektrarni, Jaslovske Bohunice (Czechoslovakia)). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Specific features of mathematical methods applied in various computer codes for small/intermediate coolant leakage analysis are considered. Advantages, drawbacks and areas of applicability are discussed for a number of codes (LENKA, RELAP, DINAMIKA, SLAP-1). The results of comparative calculations performed with the mentioned codes are analysed and the ways towards codes improvement and further development suggested. 7 refs.; 3 figs.

6057 (INIS-mf—11320, pp 289-302) **IAEA activities in the field of NPP operation safety.** Novak, S. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Safety). 1985. (In Russian). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW. (CONF-8410495—).

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

With participating of experts from the majority of IAEA member-countries constructing and operating nuclear power plants series of regulations, recommendations and other safety documents have been developed. The most important among them is NUSS (Nuclear Safety Standards) Programme. With regard to the fact that at the end of 1983 there were employed 317 NPPs all over the world with the total operation time of 3142 reactor-years, the major attention is given to using the safety standards during operation. The programme includes 55 planned guiding safety documents covering five major issues: the governmental organization of the safety problems control; the NPP site selection; NPP designing; NPP operation; the quality insurance at NPPs. The programme objective is: to provide support for the countries beginning to develop the atomic power by preparing interconnected safety standards. The guiding documents within the scope of the programme should be completed in 1985. The major aspects, that are important for the operation safety and which state is evaluated, are as follows: organization and the utility mamagement; personnel training and qualification; operation; technical support; maintenance; radiation safety; chemical regimes; planning and readiness for accidents. IAEA prepares recommendations on the foundation of national systems for the information collecting with regard to the feasibility of the information exchange with other countries, and above this it is establishing an international information system for NPP accidents that can be joined by any country operating NPPs.

6058 (INIS-mf—11320) **Thermal physics 84. Thermal aspects of WWER safety. Volume 1. Collection of papers from SMEA seminar.** (Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh). 1985. 308p. (In Russian). (CONF-8410495—). NTIS (US Sales Only), PC A14/MF A01. Order Number DE89780032/JAW.

From Thermal physics '84: thermal aspects of WWER safety; Varna, Bulgaria (1 Oct 1984).

Separate abstracts were prepared for the individual papers in this report. (JDB)

6059 (JAERI-M—88-077) **Study on the jet flow in primary coolant system pipe rupture of a light water reactor.** Isozaki, Toshikuni. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 120p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755500/JAW.

This report describes the results of jet discharge experiments under BWR/PWR Loss of Coolant accident (= LOCA) conditions conducted at the Japan Atomic Energy Research Institute. The pipe reaction thrust forces caused by the instantaneous pipe rupture and pressure, temperature increase on target by the impinging jet on it are made clear. Pipe rupture tests were done to obtain the basic data on the reaction thrust forces, jet impingement forces, pressure and temperature increase due to the impinging jet on target. (J.P.N.) 71 refs. 46 figs.

6060 (JAERI-M—88-139) **Study on the behavior of unirradiated light water reactor fuel with iodine-127 under the reactivity initiated accident (RIA) conditions.** Sasajima, Hideo; Yanagisawa, Kazuaki; Kanazawa, Hiroyuki. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 55p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755518/JAW.

In a light water reactor fuel, a stress arised from pellet-cladding interaction (PCI) will have possibility to cause stress corrosion claddling (PCI failure) under an environment of corrosive fission product ; line iodine. A pulse irradiation experiment by NSRR was carried out to examine whether or not an unirradiated NSRR standard fuel rod in which 1.3 mg (33 x 10/sup -6/ g/cm/sup 2/) of iodine was artificially filled could cause the PCI failure. Obtained results are: (1) The fuel rods with iodine did not fail both at deposited energy levels of 268 and 280 cal/g center dot UO/sub 2/. On the other hand, the fuel rods without iodine failed at the same energy levels due to thinning of the cladding wall thickness. Within this experimental scope, PCI-failure did not occur on iodine filled fuel rods. (2) At a periphery of the fuel pellet of iodine filled rod, an uniform torus ring was formed. The torus ring consisted of an equi-axed large grains at 268 cal/g center dot UO/sub 2/ and a columnar ones at 280 cal/g center dot UO/sub 2/. The torus ring was not formed in the fuel without iodine.

6061 **(JAERI-M—88-141) BWR 1 % main recirculation line break LOCA tests, RUNs 917 and 918, without HPCS at ROSA-III program. Effects of ADS delay in small break LOCA.** Suzuki, Mitsuhiro; Okazaki, Motoaki; Anoda, Yoshinari; Kumamaru, Hiroshige; Nakamura, Hideo; Yonomoto, Taisuke; Koizumi, Yasuo; Tasaka, Kanji. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 198p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755519/JAW.

In a case of small break loss-of-coolant accident (LOCA) at a boiling water reactor (BWR) system, it is important to lower the system pressure to cool down the reactor system by using either the high pressure core spray (HPCS) or the automatic depressurization system (ADS). The report presents characteristic test results of RUNs 918 and 917, which were performed at the rig-of-safety assessment (ROSA)-III program simulating a 1 % break BWR LOCA with an assumption of HPCS failure, and clarifies effects of the ADS delay time on a small break LOCA. The ROSA-III test facility simulates principal components of a BWR/6 system with volumetric scaling factor of 1/424. It is experimentally concluded that the ADS delay time shorter than 4 minutes results in a similar PCT as that in a standard case, in which the PCT is observed after actuation of the low pressure core spray (LPCS). And the ADS delay time longer than 4 minutes results in higher PCT than in the standard case. In the latter, the PCT depends on the ADS time, a 220 K higher PCT, for example, in a case of 10 minutes ADS delay compared with the standard case. (author) 52 refs. 299 figs.

6062 **(KFK—4171) CORA scoping test B. Test results report.** Hagen, S.; Hering, W.; Vogel, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Versuchstechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit). Aug 1988. 203p. NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756107/JAW.

Experiment CORA-B with AL/sub 2/O/sub 3/-pellets should test the high temperature behaviour of the facility without the danger of radioactive contamination. But the high temperature behavior of Al/sub 2/O/sub 3/-pellets in Zircaloy tubing is also of interest for the understanding of the damage initiation in burnable poison rods for PWR's. There the Al/sub 2/O/sub 3/ pellets inside the Zircaloy (Zry) cladding are the matrix for B/sub 4/C (1.4 wt.%), which is used as burnable absorber material. In test CORA-B as a result of a power input of up to 80 KW a maximum temperature of about 1800/sup 0/C was reached. Significant melting of the Al/sub 2/O/sub 3//Zry-rods started at about 1500/sup 0/C due to the interaction between Zry and Al/sub 2/O/sub 3/. The formation of a metallic (Zr, Al) alloy plays an important role in this interaction process. At the end of the test nearly the whole bundle was liquefied. The melt refroze at the lower end of the bundle forming a large lump, which was blocking the bundle cross section. The melt formation in an Al/sub 2/O/sub 3//Zry bundle is much stronger than in a UO/sub 2//Zry bundle for the same temperature history.

6063 **(KFK—4313) Interaction between aluminium oxide pellets and Zircaloy tubes in steam atmospheres at temperatures above 1200/sup 0/C. Posttest results from the CORA tests B and C.** Hagen, S.; Hofmann, P.; Schanz, G.; Sepold, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit). Sep 1988. 179p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756108/JAW.

The burnable poison rods in light water reactors (LWR) consist of Al/sub 2/O/sub 3//B/sub 4/C pellets surrounded by Zircaloy-4 cladding tubes. In the Al/sub 2/O/sub 3//B/sub 4/C pellets of a LWR rod alumina is the main constituent (98.6 wt.-%) whereas boron carbide acts as neutron absorber. Failure of the Al/sub 2/O/sub 3//Zircaloy test rods started at 1350/sup 0/C when first droplets of molten material were observed running down the test bundle forming bundle blockages upon solidification. Post test examinations revealed that the process of liquefaction was initiated by a reduction of alumina by Zircaloy resulting in a (Zr, Al, O) melt which decomposed on cooldown into two metallic phases, a (Zr, Al) alloy and oxygen-stabilized a-Zr(O). The components of an extremely porous ceramic melt were also Zr, Al, and oxygen but with a higher oxygen content compared to the metallic melt. The ceramic melt decomposes on cooldown into an Al/sub 2/O/sub 3// ZrO/sub 2/ eutectic with various amounts of primary constituents. Other types of relocated material were due to melting of essentially unreacted Zircaloy cladding and to debris formation by fracturing of oxidized cladding and Al/sub 2/O/sub 3/ pellets stack residues. The interactions between Al/sub 2/O/sub 3/ and Zircaloy occurring in a burnable poison rod are furthermore important for the behavior of the entire LWR core because the generated metals are able to attack the UO/sub 2/ chemically and dissolve or liquefy the fuel even below the melting point of Zircaloy (1760/sup 0/C). As a result, fuel elements which contain burnable poison rods are expected to fail under severe accident conditions at about 1500/sup 0/C.

6064 **(LA-UR—88-3405) Use of 2D/3D data for peak cladding temperature uncertainty studies.** Boyack, B.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8810155—5). NTIS, PC A02/MF A01 - OSTI. Order Number DE89002238/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

In August 1988, the Nuclear Regulatory Commission (NRC) approved the final version of a revised rule on the acceptance of emergency core cooling systems. The revised rule allows emergency core cooling system analysis based on best-estimate methods, provided uncertainties in the prediction of prescribed acceptance limits are quantified and reported. To support the revised rule, the NRC developed the Code Scaling, Applicability, and Uncertainty (CSAU) evaluation methodology. Data from the 2D/3D program have been used in a demonstration of the CSAU methodology in two ways. First, the data were used to identify and quantify biases that are related to the implementation of selected correlations and models in the thermal-hydraulic systems code TRAC-PF1/MOD1 as it is used to calculate the demonstration transient, a large-break loss-of-coolant accident. Second, the data were used in a supportive role to provide insight into the accuracy of code calculations and to confirm conclusions that are drawn regarding specific CSAU studies. Examples are provided illustrating each of these two uses of 2D/3D data. 9 refs., 7 figs.

6065 **(NUREG/CR—4639-Vol.3-Pt.2) Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): Guide to data processing and revision: Part 2, Human error probability data entry and revision procedures.** Gilmore, W.E.; Gertman, D.I.; Gilbert, B.G.; Reece, W.J. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1988. Contract AC07-76ID01570. 166p. (EGG—2458-Vol.3-Pt.2). NTIS, PC A08/MF A01 - GPO - OSTI. Order Number TI89003840/JAW.

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability (HEP) and hardware component failure data (HCFD). The NUCLARR system software resides on an IBM (or compatible) personal microcomputer. Users can perform data base searches to furnish HEP estimates and HCFD rates. In this manner, the NUCLARR system can be used to support a variety of risk assessment activities. This volume, Volume 3 of a 5-volume series, presents the procedures used to process HEP and HCFD for entry in NUCLARR and describes how to modify the existing NUCLARR taxonomy in order to add either equipment types or action verbs. Volume 3 also specifies the various roles of the administrative staff on assignment to the NUCLARR Clearinghouse who are tasked with maintaining the data base, dealing with user requests, and processing NUCLARR data. 5 refs., 34 figs., 3 tabs.

6066 **(NUREG/CR—5190) Closeout of IE Bulletin 80-14: Degradation of BWR scram discharge volume capability.** Foley, W.J.; Dean, R.S.; Hennick, D.A. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Projects III, IV, V and Special Projects; Parameter, Inc., Elm Grove, WI (USA)). Nov 1988. 17p. (PARAMETER/IE—172). NTIS, PC A03/MF A01 - GPO - OSTI. Order Number TI89002947/JAW.

Documentation is provided in this report for the closeout of IE Bulletin 80-14 regarding degradation of safety-related scram discharge volume (SDV) systems in General Electric (GE) boiling water reactors (BWRs). Closeout is based on the implementation and verification of six required licensee actions. Evaluation of utility responses and NRC/Region inspection reports indicates that the bulletin is closed for all of the 23 facilities to which it was issued for action. The bulletin was issued June 12, 1980, as a result of SDV events at two plants. Furthermore, studies of related anticipated transients without scram (ATWS) raised concern that the SDV function may be degraded by the undetected presence of fluid in the SDV. The bulletin was forwarded for information only to all GE power reactor facilities with a construction permit.

6067 **(SAAS-Mitt—88-01) Measures to prevent and combat unusual occurences in the use of atomic energy. Principles.** (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1988. 19-26p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704674/JAW.

To achieve the objectives set out in the Ordinance on the Assurance of Atomic Safety and Radiation Protection dated 11 October 1984, senior managers of establishments using atomic energy are responsible for planning and implementing measures to prevent UOs, and staff, material and organizational preconditions necessary to immediately combat UOs, and to limit and remedy their consequences. The principles were compiled on the basis of legal regulations in force in the German Democratic Republic taking into account national and international experience.

6068 **(TPR-NS—29-No.4) Nulcear Safety: Technical progress review, October--December 1988.** Silver, E.G. (ed.). (Oak Ridge National Lab., TN (USA)). 1988. 163p. I; GPO Dep. Order Number TI88016961/JAW.

Nuclear Safety is a review journal that covers significant developments in the field of nuclear safety. Its scope includes the analysis and control of hazards associated with nuclear energy, operations involving fissionable materials, and the products of nuclear fission and their effects on the environment. Primary emphasis is on safety in reactor design, construction, and operation; however, the safety aspects of the entire fuel cycle, including fuel fabrication, spent-fuel processing, nuclear waste disposal, handling of radioisotopes, and environmental effects of these operations, are also treated.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 5936

2509 Batteries

6069 **(CONF-890128—1) Simulation of battery performance in electric vehicle applications.** Marr, W.W.; Walsh, W.J.; Symons, P.C. (Argonne National Lab., IL (USA)). [1988]. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89000592/JAW.

From Society for Computer Simulation western multiconference; San Diego, CA, USA (4 Jan 1989).

This paper describes an interactive microcomputer software package for the prediction of battery performance in electric vehicle (EV) applications. The software, named DIANE, comprises two parts: (1) a formalized process to quantify the parameters for the battery model from laboratory test data, and (2) a second-by-second simulation of EV performance over the life of the battery. The capability of battery is modeled by an algorithm that relates the battery voltage to the withdrawn current, taking into account the effects of battery depth-of-discharge (DOD) and aging. Cycling experience is accumulated by the simulation of daily driving through a user-selected range and drive-cycle, and a maximum-range test is carried out periodically. The performance capability of the EV is thereby calculated. The simulation continues until the projected range or accelerative capability is less than that specified by the user. DIANE is written in FORTRAN for use on IBM compatible microcomputers. 3 refs., 1 fig.

6070 **(SAND—88-2736C) Li-reactivity of silicate glasses: Influence of glass composition.** Cieslak, W.R.; Reinhardt, F.W.; Maschhoff, B.L.; Lee, P.A.; Armstrong, N.R. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 15p. (CONF-8810205—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001616/JAW.

From Symposium on materials and processes for lithium batteries; Chicago, IL, USA (10 Oct 1988).

This investigation has concentrated on the reactivity of alumino- silicate glasses with lithium, in consideration of applications for separator papers in Li/$SOCl_2$ cells. Although the silicate matrix is unstable with respect to lithium, additives to the glass can decrease or increase the overall glass reactivity. We have shown that, even in the presence of a stabilizing aluminium addition, sodium oxide exchange and reduction occurs immediately, causing increased tendency to react as compared to pure silica. Addition of calcium rather than sodium to the glass, however, allows for a material with increased stability as compared to silica. 9 refs., 6 figs., 2 tabs.

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 6084

6071 **(STC/SA—7703) An energy analysis of Canadian external trade, 1966.** Hamilton, K.E. (Statistics Canada, Ottawa, Ontario. Structural Analysis Div.). 1977. 108p. (CE—02087). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

An objective of this report is to provide an analysis of the impact on the Canadian energy resource base of external trade in 1966, using an energy accounting model. Additions are made to the theory of energy analysis in chapters that deal with the assignment of energy requirements to goods and services in an economy which is open to external trade. Other chapters address the manner in which imports affect the energy required to produce commodities in Canada; the energy effects of external trade in total, including direct trade in energy commodities and trade in all other commodities; a comparison of the energy requirements per dollar of the total amount of exports and imports; a balanced trade calculation of energy requirements for commodities, felt to be perhaps the optimal measure of energy requirements in an open economy; and the effect of variations in the bill of goods exported on the balanced trade calculations. The capability of a balanced trade calculation to allow a pure measure of the complex interaction between domestic demand and external trade is explored in some detail. Mathematical proofs are given of the assertions in the text, along with an explanation of the input-output model used. 3 refs., 6 figs., 13 tabs.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 5829, 5967, 6071, 6089, 6308, 6328, 6329, 6330, 6331, 6332, 6333, 6334, 6335, 6336, 6337, 6338, 6339, 6340, 6341

6072 **(DOE/CE—0238) Support of renewable energy activities from Petroleum Violation Escrow (PVE) funds.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Sep 1988. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89001835/JAW.

The purpose of this document is to provide a reference for use by those interested in the development of renewable energy resources regarding the extent to which Petroleum Violation Escrow

(PVE) funds might be employed by states to fund research, development, demonstration and applications pertaining to such resources. The document highlights the background and status of the PVE funds being disbursed through state energy agencies and summarizes the types of energy-related activities being conducted with these funds and the processes used to select and approve these activities. These funds may provide a mechanism for expanding the contribution of renewable energy technologies to domestic energy conservation and security. 2 tabs.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 5833, 5967, 6156, 6308, 6309, 6310, 6328, 6329, 6330, 6331, 6332, 6333, 6334, 6335, 6336, 6337, 6338, 6339, 6340, 6341, 6417

6073 **(DP—1773) Risk acceptance decisions.** Bradley, R.F. (Savannah River Lab., Aiken, SC (USA)). Nov 1988. Contract AC09-76SR00001. 13p. NTIS, PC A03/MF A01. Order Number DE89003776/JAW.

The Savannah River Non-Reactor Safety Evaluation Division has been developing explicit techniques to evaluate quantified accident scenarios. The goal of the evaluation techniques is to highlight those risks that most deserve further attention. The techniques include: (a) defining the category at risk, (b) presenting the risk with clear effective tools, and (c) comparing the risk to appropriate minimum essential guidelines. 5 refs., 5 figs.

6074 **(EPS—En40-11/10-1987) Industrial Programs Branch progress report, 1986-1987.** (Environnement Canada, Ottawa, Ontario. Conservation et Protection). 1986. Vp. (In English and French). (MICROLOG—88-01340). Environment Canada. Conservation and Protection, EP Publications, Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Industrial Programs Branch monitors the activities of the industrial, municipal, and transportation sectors across Canada, determines the effect of such activities on our environment, and devises ways of lessening or preventing harm from pollution. With this mandate in mind, the Branch develops preventative and remedial measures for environmental problems, conducts and coordinates investigations, determines compliance with regulations, and assesses the applicability of new technologies and processes. The Branch makes its technical knowledge and expertise available to a wide client base across Canada. The Branch's expertise has been recognized outside Canada, and forms the basis for valuable technical and scientific exchanges with the international community. In addition to these responsibilities, the Branch develops environmental protection measures (in particular those measures relating to the control of pollutants), and fosters their implementation. Integral to this activity are the assessment of the cost-effectiveness and socio-economic implications of pollution control measures, and the promotion of the development and implementation of environmentally sound technologies and processes that may have commercial potential. There are seven divisions within the Branch: oil, gas and energy; urban activities; mining; renewable resources; transportation; chemicals; and waste management. This report summarizes the major achievements of the various branches over the year including activities in toxic chemicals management, combating acid rain, and implementing environmental policies.

6075 **(ORNL—6450/R10) Environmental regulatory update table.** Houlberg, L.; Langston, M.E.; Nikbakht, A.; Salk, M.S. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 93p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89003731/JAW.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

2904 Natural Resources

6076 **(ME—8603) Nova Scotia Dept. of Mines and Energy annual report for 1986.** (Department of Mines and Energy, Nova Scotia (Canada)). [1987]. 130p. (MICROLOG—88-05230). Nova Scotia Dept. of Mines and Energy, Joseph Howe Bldg., PO Box 1087, Halifax, N.S., Canada B3J 2X1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The mandate of the Nova Scotia Department of Mines and Energy is the encouragement of research and development leading to increased mineral and energy resources and the orderly regulation of these activities for the public benefit. This mandate is accomplished by many programs supervised by the divisions of Mineral Resources, Mining Engineering, Mineral Development, Energy Resources, Energy Management, and Administration. This report outlines the Department's activities for the year. In the energy field, information is presented on offshore petroleum exploration and development, coal exploration, development, and utilization, peatland inventory, oil substitution and conservation, energy planning and analysis, and programs to conserve energy, increase public awareness of energy, and develop renewable energy sources. 15 figs., 18 tabs.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 5835, 5839, 6003, 6072, 6074, 6099, 6229

6077 **(DOE/CE/63438—T1) On firm ground: A strategic analysis of CAA energy-related business development.** (Economic Opportunity Research Inst., Arlington, VA (USA)). Feb 1987. Contract FG01-85CE63438. 75p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89003284/JAW.

The purpose of this document is to suggest strategic planning methods through which to reduce the risks and enhance the prospects of success of Community Action Agency (CAA) energy-related business development. The objectives are the following: to provide CAA leaders with a model they can use to evaluate the broad range of business opportunities before them; to use this model to evaluate several types of new or existing enterprises of interest to CAAs in order to determine the potential for replication of the enterprises; and to provide WAP policymakers with a process to help evaluate the progress of the on-going experiment in CAA energy-related business incubation. 70 refs., 12 figs.

6078 **(DOE/EH—0077) Energy technologies and the environment: Environmental information handbook.** (USDOE Assistant Secretary for Environment, Safety and Health, Washington, DC. Office of Environmental Analysis). Oct 1988. Contract W-31109-ENG-38. 461p. NTIS, PC A20/MF A01 - OSTI. Order Number DE89003779/JAW.

This revision of Energy Technologies & the Environment reflects the changes in energy supply and demand, focus of environmental concern, and emphasis of energy research and development that have occurred since publication of the earlier edition in 1980. The increase in availability of oil and natural gas, at least for the near term, is responsible in part for a reduced emphasis on development of replacement fuels and technologies. Trends in energy development also have been influenced by an increased reliance on private industry initiatives, and a correspondingly reduced government involvement, in demonstrating more developed technologies. Environmental concerns related to acid rain and waste management continue to increase the demand for development of innovative energy systems. The basic criteria for including a technology in this report are that (1) the technology is a major current or potential future energy supply and (2) significant changes in employing or understanding the technology have occurred since publication of the 1980 edition. Coal is seen to be a continuing major source of energy supply, and thus chapters pertaining to the principal coal technologies have been revised from the 1980 edition (those on coal mining and preparation, conventional coal-fired power plants, fluid-

ized-bed combustion, coal gasification, and coal liquefaction) or added as necessary to include emerging technologies (those on oil shale, combined-cycle power plants, coal-liquid mixtures, and fuel cells).

6079 **(KFK—4448) Design of a database on institutions, projects, and publications in the field of technology assessment (TA).** Berg, I. von; Buecker-Gaertner, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse). Aug 1988. 54p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755555/JAW.

In cooperation with FIZ Karlsruhe, the Information Centre on Energy, Physics, Mathematics, the Department for Applied Systems Analysis of the Nuclear Research Centre Karlsruhe designed a database on institutions, projects, and publications in the field of technology assessment (TA). The project is being sponsored by the Federal Ministry for Research and Technology for a period of three years starting July 1987. The database will provide users in politics, administration, science, and the interested public with information on national and international research capacities and activities in the field of TA. The database is implemented on the EDP system of FIZ Karlsruhe and is offered online as File 'TA' via STN International, the worldwide accessible Scientific and Technical Network, since March 1988. This report describes the structure of the TA database which is divided into three interconnected segments: 'TA institutions', 'TA projects' and 'TA publications'. In each segment reference is made to complementary information in other segments. The report presents selected search examples and contains extensive appendices illustrating the structure of the TA database.

6080 **(MLM—3521) Technology Update - 88.** Fitzharris, P.A. (ed.). (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). Jul 1988. Contract AC04-76DP00053. 21p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88013959/JAW.

This publication communicates Mound's contributions in technology in selected areas to the industrial and academic communities, as well as to government laboratories and agencies. Mound is an integrated research, development, and production center with focus on explosives, nuclear, and energy technology. Founded in 1947, Mound is operated by Monsanto Research Corp. for the US Department of Energy.

6081 **(ORNL/CON—252) The Energy-Related Inventions Program: An assessment of recent commercial progress.** Brown, M.A.; Snell, S.A. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 84p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89003945/JAW.

This report provides information on the recent commercial progress of inventions supported by the Energy-Related Inventions Program (ERIP). The period of interest is 1980 through 1986. Data on 156 inventions were collected through telephone interviews. By the end of 1986, at least 65 inventions had entered the market, generating total cumulative sales of $272 million. With $17.1 million in grants awarded through 1986, and $43.9 million in program appropriations over the same period, ERIP has generated a 16:1 return in terms of sales values to grants, and a 6:1 return in sales versus program appropriations. It is estimated that 35% of all ERIP inventions had been commercialized, and 26% had achieved sales by the end of 1986. While it is difficult to make exact comparisons between these percentages and other indicators of the success rates of technological innovations as a whole, the ERIP figures remain impressive by most standards. Sources of funding, correlates of commercial success, and the commercialization time-line are also discussed. 28 refs., 20 figs., 10 tabs.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 6005

6082 **(IAEA-INFCIRC—354) Telex message to the Director General from the President of the Atomic Energy Organization of Iran.** (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 3p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704457/JAW.

The document reproduces the text of a telex message dated 19 July 1988 from the Deputy Prime Minister of the Islamic Republic of Iran and President of the Atomic Energy Organization of Iran to the Director General of the IAEA and the Director General's reply dated 29 July 1988, in connection with an Iraqi military attack of the Busher Nuclear Power Plant on 18 July 1988.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 6085, 6144

2910 Conservation

REFER ALSO TO CITATION(S) 6072, 6104

6083 **(NP—9771028) Lowering of energy costs in domestic waste water treatment by reduction of electricity consumption peaks. Final report.** Kunz, P.; Mueller, A. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1986. 200p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770128/JAW.

The electrical energy demand of a sewage treatment plant is dependent upon many specific factors which lead to peak use and thus increased demands on the energy supplier. According to the type of delivery contract, electrical load peaks can entail higher electricity costs. As peak loads are evidence of uneven use of the sewage plant, a more even distribution is also called for on the ground of process stability. As a result of this survey the following statement can be made (appropriate instruments for their realisation are contained in the report): Considerable saving in electricity costs can be made by checking that the contract with the supplier tallies with the actual demand, and adjusting if necessary. Opportunities for energy conservation are made evident by performance profiles drawn by sewage plant staff; the effects of the various supplies become apparent. The share of the fixed supply rate in the electricity costs can in part be substantially reduced by using a plant schedule for the organisational evening-out of electricity consumption. (orig.) With 120 refs., 23 tabs., 46 figs.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 5827, 5853, 6092

6084 **(CONF-881036—1) Environmental considerations of a fuel-flexible transportation system.** Saricks, C.L. (Argonne National Lab., IL (USA). Center for Transportation Research). 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003659/JAW.

From APCA specialty conference on environmental challenges in energy utilization during the 90's; Cleveland, OH, USA (10 Oct 1988).

The United States Department of Energy Office of Policy, Planning, and Analysis in conjuction with the Office of Environmental Analysis is conducting a multi-faceted, multi-organization study of the prospects for and costs of implementing a fuel-flexible (multifuel) domestic transportation system by the year 2000. The analysis has three components: (1) forecasting the supply of candidate alternative fuels (chiefly methanol, compressed natural gas, and electricity) by about year 2000, and of propulsion systems to

use them; (2) projecting vehicular sales, fuel distributing and dispensing, and vehicular service infrastructures needed to support a "best case" penetration of each of these fuels individually or in combination into the national automobile, light and medium truck, and bus populations; and (3) considering changes in the environmental effects of transportation activity that could result from the fleet penetrations implicit in these cases. This paper presents the currently-proposed objectives and scope of the last of these three areas of analysis, and reviews environmental issues already identified as potential concerns for a period of transition to non-petroleum fuel dominance or at least of significant displacement of petroleum use in domestic transportation. These issues include performance and durability of vehicular emission control systems, formaldehyde transients of alcohol fuels, use of catalysts with heavy-duty vehicles, synergistic effects of gasoline/alcohol blends, safety of gas compressor systems, reduction of emissions of oxides of nitrogen, control of environmental release pathways for methane and toxic gases or solids, and institutional and legal constraints in some locations on the use of non-petroleum fuels in transportation. 20 refs., 1 fig.

6085 **(DOE/EIA—0035(88/08)) Monthly Energy Review, August 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 28 Nov 1988. 137p. NTIS, PC A07/MF A01 - GPO - OSTI. Order Number DE89003848/JAW.

The Monthly Energy Review presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear-powered facilities. The Monthly Energy Review is intended to provide timely energy information to members of Congress, to federal and state agencies, and to the general public.

6086 **Weather, the estimation of residential energy demand relationships and the reporting of data.** Herbert, J.H. (USDOE Energy Information Administration, Washington, DC). *Energy Economics;* **10**: No. 4, 324-325(Oct 1988).

The need for adjusting energy related data, especially weather data, prior to estimating demand relationships is pointed out. Previous studies are used as examples. The lack of such adjustments could affect greatly the estimated results. The desirability of making data available along with an article is also pointed out.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 6074, 6075, 6417

6087 **(DOE/CE/63438—T2) Roundtable on prevention of fraud and abuse in low income weatherization programs, March 23--24, 1987, Highland Hotel, Washington, DC.** (Economic Opportunity Research Inst., Arlington, VA (USA)). 1987. Contract FG01-85CE63438. 144p. NTIS, PC A07/MF A01 - OSTI. Order Number DE89003283/JAW.

This report contains: Identification of Issues and Preventive Measures Associated with Fraud and Abuse in Low Income Conservation Programs; Working Papers Prepared by Roundtable Discussants; Annotated Bibliography of Publications Related to Prevention/Detection of Fraud and Abuse in DOE and LIHEAP Conservation Programs; and List of Members on Task Force for Prevention of Fraud and Abuse in Low Income Weatherization Programs.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 5803, 5825, 5829, 5829, 5835, 5853, 6076, 6085

6088 **(ANL/ES—156) Novel concepts for the utilization of fossil resources.** Wolsko, T.D.; Gillette, J.L.; Hub, K.A.; Kumar, R.; Lyczkowski, R.W.; Maroni, V.A.; McIntosh, M.J.; Mego, W.A.; Rajan, J.B.; Vissers, D.R. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Mar 1988. Contract W-31109-ENG-38. 200p. NTIS, PC A10/MF A01 - OSTI. Order Number DE89002811/JAW.

Current petroleum prices are bringing about increased US dependence of foreign oil. New approaches for increasing fossil resource utilization are needed in this century to insulate the United States from potential economic shocks resulting from increased prices or reduced foreign oil production. The objective of this project was to search for innovations that could provide improvements perceived to be better than the evolutionary improvements resulting from current technology research. The search was for radically different (revolutionary) ideas rather than evolutionary ideas. Innovative ideas were generated in the following areas: direct and indirect liquefaction; oil shale; underground coal gasification; enhanced oil, heavy-oil, and tar-sand-bitumen recovery; Alaskan resources; and end-use concepts. Novel concepts were pursued by reconsidering oil ideas as well as by original thinking. Six steps were used to develop these novel concepts (problem characterization, idea generation, idea screening, concept development, concept evaluation, and research and development recommendation). Of the more than 200 ideas initially suggested, 144 are described in this report. Thirteen of these ideas were developed further. The "biocatalytic depolymerization" concept was considered to be the idea that most closely achieved the objectives of the project. 56 refs., 12 figs., 15 tabs.

6089 (CERI—1988, pp 2) **Outlook for petroleum exploration in the third world.** Churchill, A.A. 1988. Canadian Energy Research Institute, Calgary, Alberta. (CONF-8809206—; CE—02029).

From 7. CERI international oil and gas conference; Calgary, Canada (18 Sep 1988).

This presentation briefly examines three factors governing the attractiveness of petroleum exploration and development in third world countries. The world petroleum market in the 1990s, and the demand for petroleum products in the third world, will continue to be the dominant factor in determining prices and subsequent supply responses. Given the modest expectations for price increases, the combination of exploration/development costs and expected rates of return will also be an influence. The internal market growth in the developing countries will produce most of the increase in petroleum demand and will most likely be the most profitable part of the market. The World Bank's role in improving the investment climate is also mentioned.

6090 (CERI—1988, pp 16) **Oil and gas policies and prospects in Brazil - from present to 2005.** Franke, M.R. (State Oil Co. of Brazil, Rio de Janeiro). 1988. Canadian Energy Research Institute, Calgary, Alberta. (CONF-8809206—; CE—02029).

From 7. CERI international oil and gas conference; Calgary, Canada (18 Sep 1988).

This presentation summarizes the evolution of energy consumption and oil and gas production in Brazil. Before the oil price increases of the 1970s, petroleum and hydroelectricity were the main energy sources. The shock of those price increases has caused adoption of policies which emphasize petroleum exploration and production, encourage energy conservation, and promote replacement of petroleum products with alternatives such as alcohol fuels. Oil and gas production has increased ca 270% from 1979 to 1988, and reserves have doubled in a 10-year period. An effective national program has been instituted to increase use of alcohol as a gasoline additive and as a direct fuel. Fuel oil is being replaced by coal in industries. Other fuel products experiencing significant increases in the fuel demand structure are diesel fuel, liquefied petroleum

gases, and gas oil/naphtha. Brazilian dependence on imported petroleum, currently ca 45% of consumption, should decrease in the near future, considering the oil industry's excellent prospects. 16 figs.

2960 Electric Power

REFER ALSO TO CITATION(S) 6128, 6139

6091 **(DOE/BP—1103) Conservation and load-management research plans: 1989 North American index.** Biemer, J.; Freeman, D. (comps.). (USDOE Bonneville Power Administration, Portland, OR. Office of Energy Resources). Oct 1988. 146p. NTIS, PC A07 - OSTI. Order Number DE89003504/JAW.

Traditional conservation and load management (C&LM) planning processes focus on the resources of one organization. Recently, a number of consortium-forming efforts have sought to pool resources around selected large scale research efforts. Co-participation has been encouraged by initiating organizations requiring matching funds. Conducting a "literature search" for related research, before beginning a project is now standard procedure. Data bases, indexes, and bibliographies are available to access completed (and to some extent current) research. Still, basic inefficiencies in conducting C&LM research persist. Research may be pursued along parallel paths for some time before one party discovers the work of the other. Literature searches often do not capture projects in progress, still in the planning stages, or which have never been published. Top down planning processes often do not account for the activities of non-participants. Inertia and particular circumstances make it difficult for one organization to participate in another's formal planning process. As with many other organizations, Bonneville Power Administration has very limited funds to accomplish its Conservation and Load-Management (C&LM) research objectives. In an effort to better use Bonneville's resources, a survey of the broadest possible spectrum of other organizations' C&LM research plans was conducted during the Summer of 1988. To further refine this effort, a workshop was held in Pacific Grove, California in conjunction with the American Council for an Energy Efficient Economy (ACEEE) Summer Study.

6092 **(DOE/EIA—0226(88/09)) Electric power monthly, September 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 9 Dec 1988. 50p. NTIS, PC A03/MF A01 - GPO - OSTI. Order Number DE89004557/JAW.

During September 1988, total US net generation was 220,035 gigawatthours, 3 percent higher than during the same period last year. The Pacific Contiguous Census Division was the only Census division that reported a lower level of generation (1 percent less) during September 1988, compared with September 1987. The West North Central Census Division reported the largest percentage gain (9 percent) in production of electricity over September 1987. Net generation from petroleum showed the strongest percentage gain at 30 percent among the energy sources during September 1988, compared with the same month last year. Nearly all of the petroleum-fired generation was produced by plants located along the eastern seaboard. The New England, Middle Atlantic, and South Atlantic Census Divisions produced 88 percent of the total US generation from petroleum during the month. Nuclear-powered plants continued to show strong gains, producing 46,270 gigawatthours of electricity in September 1988, 17 percent above the amount reported last year.

6093 **(ERCB—88-A) Small power inquiry, proceedings 870621. Report to the Lieutenant Governor in Council.** (Energy Resources Conservation Board, Calgary, Alberta (Canada); Alberta Public Utilities Board, Edmonton (Canada)). 1988. 69p. (CE—02054). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

An inquiry was called to inquire into, report upon, and make such recommendations as are necessary or advisable respecting generation by small power generators in Alberta. Electric utilities, municipalities, the Small Power Producers of Alberta, and various other interested intervenors participated in the inquiry. Based on the current and forecast circumstances in Alberta, it was recommended that the Alberta Government adopt a policy that would facilitate the production of electric energy by independent producers in parallel with the Alberta interconnected system (AIS). Initially, a maximum of 100 MW of capacity of small power generators be interconnected since this would not result in significant negative impact on the reliability of the system, nor would it substantially increase the cost of electricity to consumers if power is produced by the AIS from small power producers at prices contained in this report. The prices paid to small power producers by utilities should be based on utility long-term avoided costs in order to ensure that prices to consumers would not increase. The prices should vary according to the reliability, availability, term of contract, and commencement of contract. The current banking arrangements for wind-powered electric generators should continue until these arrangements are reviewed at the end of 1989. It was also recommended that standard contracts be developed by the utilities, for as-available and firm power purchases on a system-wide basis. 1 fig., 2 tabs.

6094 **(NERC—9003357) 1988 reliability assessment: The future of bulk electric system reliability in North America, 1988-1997.** (North American Electric Reliability Council, Princeton, NJ (USA)). Sep 1988. 76p. North American Reliability Council, 101 College Road East, Princeton, NJ 08540-6601. Order Number TI89003357/JAW.

Electricity supply is expected to be adequate in most parts of the United States and Canada over the next ten years. However, many forces and trends are creating risks to this future supply. If the forces and trends are not carefully managed, the specific problems identified in this Reliability Assessment could become commonplace. This Reliability Assessment identifies several geographic areas where electric system reliability is at serious risk. Emergency measures, including controlled interruptions of customers' supply, are possible in these areas.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 6092

6095 **(DOE/EI/20478—T1) State heating oil program: Final report, September 1987--June 1988.** (New York Energy Office, Albany (USA)). 31 May 1988. Contract FC01-87EI20478. 28p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003992/JAW.

The New York State Energy Office monitored retail and wholesale prices of No. 2 heating oil during the September 2, 1987--May 31, 1988 heating season in fulfillment of its contractural obligation. In addition, inventories were reported on primary and secondary level stocks. The accumulated information was submitted to EIA biweekly via Dialcom according to pre-arranged schedule. During the peak demand period, December through February, required data was transmitted on a weekly basis. The New York State weighted average retail price of No. 2 heating oil during the reported period revealed a slight price increase early in the season which leveled off after January. The previous year's price increased more dramatically with a peak in February followed by a slight decline. The wholesale prices increased in October--November and started a steady decline in December until April when an increase was reported. Inventory levels in primary storage at the beginning of the season were lower than the previous year. Seasonal build-up occurred during the peak cold months but inventories were well below the previous year. The survey sample design and reporting was in strict compliance with the appropriate guidelines and other contractural agreements between the US Department of Energy and the State of New York. See Attachment 1 for details of the Notice of Financial Assistance Award. All required data, analysis and pertinent information was transmitted via Dialcom on a timely scheduled reporting basis. 6 figs., 5 tabs.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 6093

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

6096 **(DOE/ET/10815—122) Magnetohydrodynamics coal-fired flow facility: Quarterly progress report, July--September 1987.** (Tennessee Univ., Tullahoma (USA). Space Inst.). Sep 1988. Contract AC02-79ET10815. 27p. (UTSI—87-08). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001752/JAW.

In this Quarterly Technical Progress Report, UTSI reports on progress in developing the technology for the steam bottoming cycle for MHD-Steam Combined Cycle Power Plant application. The results of a 205-hour coal fired test are described. Performance of the Low Mass Flow Train components and the DOE Coal Fired Flow Facility (CFFF) systems are reported. Failures of components and actions taken to correct problems are discussed. Application of advanced instrumentation by both UTSI and MSU are detailed. The status of other contractual tasks including Studies and Analyses, Environmental Control, Component Development and Management and Administrative Support are reported. 6 figs., 2 tabs.

3005 Fuel Cells

6097 **(ORF—870227) Characterization of thin films used as electrodes in electrochemical devices. Phase 2. Final report.** Haley, M.P. (Ontario Research Foundation, Sheridan Park (Canada)). 1987. 176p. (MICROLOG—88-01188). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The work described in this report examines a variety of physical methods which have been applied to the characterization of thin film morphology. Such thin films are used in porous electrodes in such devices as fuel cells, and development of suitable characterization techniques is necessary to understand the dependence of physical morphology on their operational behavior. This paper is concerned with continuing previous research on the important morphological properties of porous electrodes as they relate to a number of physical and chemical processes occurring in solid state fuel cells. Properties such as pore size, surface roughness, porosity, thickness, surface area, permeability, and pore/particle interface have all been evaluated using conventional and/or novel techniques. The techniques investigated include image analysis, profilometry, permeametry, porosimetry, and gas adsorption. The results of this study indicate that each technique employed has certain limitations with regard to sensitivity, resolution, and range as well as being somewhat dependent on materials composition. In addition, the methods used to prepare the films were found to be less than adequate with regard to morphological reproducibility. Overall, a few techniques have been identified which show sufficient merit to warrant further investigation, particularly for evaluating the relationship between electrode morphology and electrochemical operational behavior. A Pascal computer program listing is included, to be used for numerical solution of a fractal descriptor based on a profilometer output. 34 refs., 72 figs., 28 tabs.

6098 **Electrolytic cell stack with molten electrolyte migration control.** Kunz, H.R.; Guthrie, R.J.; Katz, M. (to Dept. of Energy). US Patent Application 6-026,819. 17 Mar 1987. 19p. Contract AC21-79ET15440. DE89000107 NTIS, PC A03/MF A01. Order Number DE89000107/JAW.

An electrolytic cell stack includes inactive electrolyte reservoirs at the upper and lower end portions thereof. The reservoirs are separated from the stack of the complete cells by impermeable, electrically conductive separators. Reservoirs at the negative end are initially low in electrolyte and the reservoirs at the positive end are high in electrolyte fill. During stack operation electrolyte migration from the positive to the negative end will be offset by the inactive reservoir capacity. In combination with the inactive reservoirs, a sealing member of high porosity and low electrolyte retention is employed to limit the electrolyte migration rate. 5 figs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 5849, 5894, 5936, 6077, 6086, 6087, 6409, 6411

6099 **(BNL—41717) An agenda for cooperative R and D in advanced, energy-efficient housing.** Levy, M.E.; Jones, R.F. (Levy Partnership, New York (USA); Brookhaven National Lab., Upton, NY (USA)). Feb 1988. Contract AC02-76CH00016. 60p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003792/JAW.

Relative to its size in the national economy the home building sector, and related organizations, conduct little research and development. Yet, many of the problems that face the industry today, and are expected to confront the industry in the future, and many of the opportunities for creating a more vibrant and internationally competitive industry, are inextricably linked to a strong R and D agenda. This study continues the much-needed process of identifying the logical role for public agencies in conducting and promoting energy-related housing research. Research needs must be illuminated against the backdrop of a housing industry undergoing changes that may fundamentally alter the way homes are built, regulated, financed and marketed. The anticipated sharp rise in fossil fuel prices, the crisis in housing affordability, the growing presence of foreign housing and housing products, and the internationalization of the housing business are some of the pressures that are instigating change. This study concludes that in order for housing to evolve in ways that are responsive to the problems the housing industry faces today and those that are anticipated in the future, a well-planned and well-coordinated program of publicly supported R and D is essential. In particular, energy-related R and D is shown to crosscut four areas that include: the technology of construction, the types of communication linkages that bind the organizations that conduct R and D and those that use it, and the regulatory and lending processes. In each area R and D activities are proposed that are designed to improve residential energy-efficiency while keeping pace with trends in new construction. 12 refs., 4 figs.

6100 **(BRE-IP—10/88) Performance of gas-fired condensing boilers in family housing.** Trim, M.J.B. (Building Research Establishment, Watford (UK)). Aug 1988. 4p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756040/JAW.

This paper describes the results and lessons learned from the extensive monitoring of groups of occupied family houses in which gas-fired condensing boilers are used for space and domestic hot water heating. It also examines the economics of these systems. The paper is addressed to builders, building services engineers, architects, heating installers and suppliers, housing authorities, housing associations, owner-occupiers and others concerned with the provision of heating in housing.

6101 **(DOE/BP/12921—1) A comparison of indoor air quality in conventional and model conservation standard new homes in the Pacific Northwest: Final report.** Turk, B.H.; Grimsrud, D.T.; Harrison, J.; Prill, R.J. (USDOE Bonneville Power Administration, Portland, OR. Div. of Resource Management; Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AI79-83BP12921;AC03-76SF00098. 59p. (LBL—23429). NTIS, PC A04/MF A01 - OSTI. Order Number DE89003790/JAW.

Ventilation and indoor air quality measurements have been made in 61 new houses located in two regions of the Pacific Northwest. Twenty-nine houses built to Model Conservation Standards (MCS) were compared to 32 Control houses, i.e., new houses built using conventional practices in the region. The MCS houses met the objective of having significantly reduced air leakage area. Yet

their total ventilation rate (infiltration plus mechanical ventilation supplied by air-to-air heat exchangers) was the same as the infiltration rate observed in the sample of Control houses. These ventilation rates in both samples were about 0.3 ach. Indoor pollutant concentrations were observed to be only poorly correlated with ventilation rates, an indication that other variables including pollutant source strengths and occupancy effects may be important. Pollutant measurements made in both samples revealed that 11% of the houses exceeded the BPA mitigation action level of 5 pCi/l for radon concentrations, while 16% exceeded the EPA guideline of 4 pCi/l. Thirty percent of the total houses exceed the 100 ppB formaldehyde guideline adopted by many organizations. Indoor pollutant concentrations were seen to vary more between geographic regions than between the two types of house construction. 40 refs., 27 figs., 4 tabs.

6102 **(DOE/CE—0223-Vol.1) COSTSAFR 2.0---User's manual (Conservation Optimization Standard for Savings in Federal Residences): In support of interim energy conservation standards for new federal buildings.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Building Systems Div.). Jun 1988. 91p. NTIS, PC A05/MF A01 - OSTI - Order software packages from National Energy Software Center, Argonne National Laboratory, 9800 South Cass Avenue, Argonne, IL 60439. Order documentation without complete package from NTIS.. Order Number DE89003448/JAW.

This document describes how to use the computer program developed under the Federal Residential Standard Project funded by the Department of Energy. The computer program provides an analysis of specific housing projects at a given site, using alternative fuel types, and considering alternative housing types. Designed around the concept of minimizing overall costs through energy conservation design--including first cost and future utility costs--the computer program established a standard design to which proposed housing designs are compared. It then provides a point table, for each housing type, that can be used to determine whether a proposed design meets the standard and how a design could be modified to meet the standard. The computer program has been designed for IBM-PC or compatible computers and is reported on a floppy disk. This manual describes how to use the program and how to read the information that appears on the screen during program operation. IT describes the inputs required and the various options presented to the user. The appendices provide more detailed information related to the output produced by the program. This output consists of point tables presenting points for each energy conservation option, and a point total that must be met to comply with the standard.

6103 **(DOE/CE—0223-Vol.3) Environmental assessment in support of interim energy conservation standards for new federal residential buildings.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Building Systems Div.). Jun 1988. 201p. NTIS, PC A10/MF A01 - OSTI. Order Number DE89003389/JAW.

This environmental assessment is a study done in support of the Standards and Guidelines Program, of the Architectural and Engineering Systems Group, Building Systems Division. The Energy Conservation Standards Act of 1976, as amended, requires the Department of Energy (DOE) to issue performance standards for the design of new buildings. These standards are to be mandatory for the design of new Federal buildings and voluntary for all other buildings. DOE is to publish interim standards, report to Congress on the results, and promulgate a final standard. The DOE has divided the development of these standards into two parts, residential buildings and commercial buildings. The residential building portion has been further divided into Federal and non-Federal buildings due to the specialized nature of Federal residential buildings, which primarily house military personnel, and the method used to procure housing. This environmental assessment supports the Federal Residential Buildings Energy Conservation Standard portion of that program. It specifically supports the issuance of a Notice of Proposed Rulemaking (NOPR) for the Federal Residential Building Standards, which is a step in developing the Interim Federal Residential Building Standards intended to permit the broadest public comment and input to the standard under development. 202 refs., 15 tabs.

6104 **(DOE/CE—0223-Vol.4) Economic analysis in support of interim energy conservation standards for new federal residential buildings.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Building Systems Div.). Jun 1988. Contract AC06-76RL01830. 60p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003349/JAW.

The objective of this document is to prevent an analysis of the impacts of the proposed standard as applied to construction of new residential buildings for the federal sector. This analysis examines the impacts of applying the proposed residential standard exclusively to federal sector construction of new residential buildings. It does not address commercial construction, nor does it examine the impact of possible adoption of the standard on design of private sector residential buildings. 6 refs., 18 tabs.

6105 **(DOE/CE/64614—T2) Nebraska Public Buildings Energy Program: A comprehensive approach to energy conservation in public and institutional buildings.** (Nebraska Energy Office, Lincoln (USA)). Jul 1988. Contract FG01-86CE64614. 324p. NTIS, PC A14/MF A01 - OSTI. Order Number DE89003062/JAW.

During the spring of 1988, the Nebraska Public Buildings Energy Program Task Force met to identify programs to help public sector and private nonprofit organizations reduce energy costs in their facilities. The Task Force, staffed by the Nebraska Energy Office and a group of consultants led by Technical Development Corporation, developed technical assistance and financing options to facilitate the implementation of major energy improvement projects. The program design process took into account the technical potential for energy efficiency in various kinds of facilities, capital budgeting and financing practices in the different jurisdictions, and the policy goals of the Nebraska Energy Office. As a result of these considerations, the Task Force designed different programs for two groups: State government facilities, and the facilities of local jurisdictions including municipal and county government, school districts, health care institutions and private colleges. The Nebraska Energy Office then retained Technical Development Corporation to conduct research on the market for these programs among local jurisdictions, and to prepare recommendations concerning program implementation and marketing.

6106 **(DOE/ER/60581—T2) Effects of vegetation on radon transport processes in soil: Performance report, November 1, 1987--October 31, 1988.** Whicker, F.W.; Borak, T.B. (Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). 1988. Contract FG02-87ER60581. 21p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003539/JAW.

Research has shown that vegetation can significantly enhance the escape of soil radon to the atmosphere. Several possible mechanisms, including soil drying, soil permeability enhancement, and evapotranspiration apparently contribute to this phenomenon, but the relative importance of each of these mechanisms has not been quantified. Because plants are known to alter radon dynamics in soil, they may, in some cases, be an important source of variation for radon transport into subterranean spaces. This research will test the hypothesis that the presence and the functions of plants can increase soil radon flow to the atmosphere, thus measurably reducing the flow into subsurface spaces. The hypothesis will be tested using two virtually identical subterranean structures, one serving as a control (without surrounding vegetation) and the other serving as the treatment (surrounded by vegetation). The two structures and surrounding soil will be thoroughly characterized before inducing treatment differences. This includes relative indoor radon concentrations, soil/basement and atmosphere/basement pressure differentials, soil temperature and moisture profiles. The response of indoor radon concentrations to induced soil moisture changes will also be studied. 4 refs., 8 figs.

6107 **(DOE/SF/16305—2) Theoretical and computational investigation of algorithms for simultaneous heat and moisture transport in buildings: Task 2 final report.** Kerestecioglu, A.; Swami, M.; Dabir, R.; Razzaq, N.; Fairey, P. (Florida Solar Energy Center, Cape Canaveral (USA)). Oct 1988. Contract FC03-86SF16305. 281p. (FSEC-CR—191-88). NTIS, PC A13/MF A01. Order Number DE89002082/JAW.

This report covers the first year of a multiyear effort designed to develop mathematical modeling capabilities for simultaneous heat and moisture transport in buildings. This effort represents only one task of a cooperative research project with five major initial year elements: moisture research; analytical methods; radiant barrier systems; enthalpy exchange systems; and integrated systems research. The objective of the overall project is to develop research capabilities needed for the development and analysis of building integrated solar cooling and dehumidification alternatives suitable for hot, humid climates prevalent in the southeastern United States.

6108 **(ECRC/M—2262) Predicting space heating energy.** Brundrett, G.W.; Poultney, G. (Electricity Council Research Centre, Capenhurst (UK)). Aug 1988. 50p. Available from: Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

This study compares the performance of ESIBEEP (a computerised energy calculation procedure) with its two earlier professional guides, the manual CIBSE procedure and the programmable RIBA calculator. Data from eleven buildings are used as examples. ESIBEEP is shown to provide excellent predictions of actual space heating energy consumption in widely different types of building. There is disagreement between the Electricity Council and CIBSE on the appropriate values to use for electric heating systems efficiency and for the ventilation rates of buildings. The agreement between all the programs and the real building energy consumption improved when the same input assumptions were used. The predicted energy use is shown to vary widely with air change rate particularly for the large volume buildings.

6109 **(ECRC/M—2300) Compression-absorption heat pumps.** Hodgett, D.L.; Aahlby, L. (Chalmers Technical University, Gothenberg (Sweden). Department of Heat and Power Technology). (Electricity Council Research Centre, Capenhurst (UK)). Sep 1988. 15p. Available from: Electricity Council Research Centre, Capenhurst, Chester, CH1 6ES, UK.

A theoretical study has been conducted of the combination of compression and absorption to produce cycles which have the potential to operate over a wide range of temperatures. An initial analysis of the 19 possible heat pump cycles with up to three pressure and three temperatures showed that there were three cycles which could be attractive. These were then studied in greater detail to identify the operating conditions which would give optimum performance. The compression-absorption cycles showed higher COPs and smaller compressor sizes than the conventional single fluid compression heat pump for most of the conditions considered and in several case studies they were superior to the conventional systems. The study currently concentrates on the analysis of the losses within these cycles and their reduction by modifications to the cycle and the design of the individual components.

6110 **(EMR—1983) Residential groundwater heat pump.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada); Manitoba Ministry of Energy and Mines, Winnipeg (Canada)). [1983]. 10p. (CE—02079). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This booklet describes the basic principles of heat pumps, with emphasis on the kind of pump most suited for residential application in rural Manitoba, i.e. a heat pump using ground water as the heat source. Criteria are presented for assistance in deciding whether installing such a pump would be practical. Advantages of the heat pump include energy efficiency, cost effectiveness after the payback period, and ability to both heat and cool the house. Disadvantages include initial cost, maintenance costs, possible deposition of scale in the system by the ground water, and possible need for supplementary heating if the outdoor temperature is low enough. 1 fig.

6111 **(EMR/ERL—SP88-1E) Efficient residential oil-heating systems. A manual for servicemen, designers and builders.** Hayden, A.C.S.; Braaten, R.W. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). 1988. 58p. (MICROLOG—88-04984). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This book is intended as a guide to improve the efficiency of domestic oil-fired furnace systems, both by changing or expanding the emphasis of periodic maintenance and by actual physical modifications to the heating system. Furnace efficiency is explained and factors that affect it are set out in detail. Instructions are given for annual servicing and testing. Methods for reducing fuel consumption are described, including thermostat cutbacks, adjustments to the circulating fan, and proper installation of ducts. In a chapter on retrofitting furnaces for improved efficiency, new burners and components, and their installation methods, are outlined. A number of basic energy-conserving tips, such as caulking air leaks and changing air filters, are listed. Included are calculation methods and tables for determining furnace efficiency, optimum nozzle size, fuel consumption, and combustion air. 17 refs. 51 figs., 3 tabs.

6112 **(EMR/ERL—SP88-1F) Efficient residential oil-heating systems. A manual for servicemen, designers and builders.** Hayden, A.C.S.; Braaten, R.W. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). 1988. 67p. (In French). (MICROLOG—88-04985). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This book is intended as a guide to improve the efficiency of domestic oil-fired furnace systems, both by changing or expanding the emphasis of periodic maintenance and by actual physical modifications to the heating system. Furnace efficiency is explained and factors that affect it are set out in detail. Instructions are given for annual servicing and testing. Methods for reducing fuel consumption are described, including thermostat cutbacks, adjustments to the circulating fan, and proper installation of ducts. In a chapter on retrofitting furnaces for improved efficiency, new burners and components, and their installation methods, are outlined. A number of basic energy-conserving tips, such as caulking air leaks and changing air filters, are listed. Included are calculation methods and tables for determining furnace efficiency, optimum nozzle size, fuel consumption, and combustion air. 17 refs. 51 figs., 3 tabs.

6113 **(INA/TSC—EA-HQ-83-83) Report on the condition of the Department House, Resolute Bay, N.W.T.** (Department of Indian and Northern Affairs, Ottawa, Ontario (Canada). Technical Services and Contracts). 1983. 17p. (CE—02074). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A government building in the Northwest Territories, used by the Ministry of Transport as a residence and office, was inspected in 1983 and the results and recommendations from that inspection are presented in this report. A number of problems needing maintenance and repair work were identified. These included condensation on walls and panels, thermal bridging, leaky windows, too little insulation, inadequate weatherstripping, and faulty roof. The problems are felt to be rectifiable by a thorough, well-designed retrofit which will extend the building's useful life and decrease heating costs. Among the recommended work to be done is: adding more insulation onto the building exterior; sealing and weatherstripping in a proper manner; improve ventilation; install better windows and close up any unnecessary ones; and repair the water supply system, which currently uses an electrical heater that oper-

ates continuously and wastes energy. Total cost of the recommended work is $85,000. 20 figs.

6114 **(LBL—24270) Improving the performance of air-conditioning systems in an ASEAN [Association of South East Asian Nations] climate.** Busch, J.F.; Warren, M.L. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 27p. (CONF-8809103—4). NTIS, PC A03/MF A01 - OSTI. Order Number DE89000564/JAW.

From 5. annual symposium on improving building energy efficiency in hot and humid climates; Houston, TX, USA (13 Sep 1988).

This paper describes an analysis of air conditioning performance under hot and humid tropical climate conditions appropriate to the Association of South East Asian Nations (ASEAN) countries. This region, with over 280 million people, has one of the fastest economic and energy consumption growth rates in the world. The work reported here is aimed at estimating the conservation potential derived from good design and control of air conditioning systems in commercial buildings. To test the performance of different air conditioning system types and control options, whole building energy performance was simulated using DOE-2. The 5100 m{sup 2} (50,000 ft{sup 2}) prototype office building module was previously used in earlier commercial building energy standards analysis for Malaysia and Singapore. In general, the weather pattern for ASEAN countries is uniform, with hot and humid air masses known as "monsoons" dictating the weather patterns. Since a concentration of cities occurs near the tip of the Malay peninsula, hourly temperature, humidity, and wind speed data for Kuala Lumpur was used for the analysis. Because of the absence of heating loads in ASEAN regions, we have limited air conditioning configurations to two pipe fan coil, constant volume, variable air volume, powered induction, and ceiling bypass configurations. Control strategies were varied to determine the conservation potential in both energy use and peak electric power demands. Sensitivities including fan control, pre-cooling and night ventilation, supply air temperature control, zone temperature set point, ventilation and infiltration, daylighting and internal gains, and system sizing were examined and compared with a base case which was a variable air volume system with no reheat or economizer. Comfort issues, such as over-cooling and space humidity, were also examined.

6115 **(LBL—25909) Monitoring and evaluation of radon mitigation systems over a two-year period.** Prill, R.J.; Fisk, W.J.; Turk, B.H. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 20p. (CONF-8810134—3). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002921/JAW.

From Symposium on radon and radon reduction technology; Denver, CO, USA (17 Oct 1988).

Fourteen single-family detached houses in the Spokane, Washington, and Coeur D'Alene, Idaho, area were tracked for two years following mitigation for elevated indoor concentrations of radon. Each house was monitored quarterly using mailed alpha-track radon detectors deployed in each zone of the structure. During the second heating season following mitigation, radon concentrations were monitored continuously for several weeks in seven of the houses, each house and mitigation system was inspected and selected measurements were performed in order to access mitigation system performance. Occupants were also interviewed regarding their maintenance, operation, and subjective evaluation of the radon mitigation system(s). The quarterly alpha-track measurements showed an increase in radon levels in a majority of the homes during many of the follow-up measurement periods compared to concentrations measured immediately after mitigation. The greatest increases in radon concentrations occurred in 3 of the 4 houses equipped with basement pressurization systems where radon levels approached the pre-mitigation levels during at least one of the follow-up measurement periods. In some of the houses mitigated with subsurface ventilation, radon concentrations generally increased over the course of the follow-up periods. Factors causing decreased mitigation system performance included: (1) build up of debris on the soil at the outlet of subsurface pressurization pipes; (2) noisy and vibrating fans were turned off; (3) air-to-air heat exchanger, basement pressurization, and subsurface ventilation fans were turned off and fan speeds reduced; and (4) crawl space vents were closed or sealed. 7 refs., 2 figs., 2 tabs.

6116 **(MRAIC—8702) Condensation in manufactured housing.** Lee, T.G. (MRAIC, Calgary, Alberta (Canada)). 1987. 133p. (MICROLOG—88-00079). Alberta Municipal Affairs, Jarvis Bldg., 6th Floor, 9925-107 St., Edmonton, Alta., Canada T5K 2H9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Mobile homes currently play a significant role in satisfying Alberta housing requirements. In recent years, mobile home manufacturers have responded to consumer demands to build units which incorporate the latest in wall technologies, materials, and energy efficiency. Nevertheless, a number of the newer homes have exhibited an unacceptable incidence and level of surface condensation and resultant envelope deterioration. This report documents a study of this problem, including a literature search and field surveys. Due to the limited literature available concerning mobile home condensation, extensive works were reviewed on condensation in wood framed structures with particular emphasis on small residential construction. The field investigations disclosed that most of the units which suffered from condensation buildup also suffered from a lack of proper ventilation. It became obvious that the more tightly sealed, non-vented units with recirculating kitchen fans, and broken or unused bathroom exhausts, exhibited some of the worst condensation problems. It was concluded that condensation can be readily reduced or eliminated by modest and cost-effective interventions. The report summarizes these in three categories: lifestyle and maintenance activities to reduce moisture generation and improve its venting; remedial construction activities or adjustments to mechanical equipment which will improve envelope performance or enhance exhausting of moist air; and changes in the design, construction, or siting of new units to reduce thermal bridging, improve air circulation and temper adverse site conditions. 73 refs., 22 figs., 5 tabs.

6117 **(NECA—TS1-01) Air leakage control.** (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). 1988. vp. (CE—02034). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $100.00 CAN.

This manual for housing contractors involved in air leakage control begins with a description of the house as a system, involving components (building envelope, mechanical system, and occupants) that interact and affect the performance of the whole. In order to plan an air leakage control strategy, methods are presented for taking an airtightness test, reviewing and reconciling technical information and customer priorities, managing the job, using proper customer relations, and using safety procedures. Use and maintenance of tools, and selection of sealing materials, are also described. Further chapters detail specific procedures for air leakage control in attics, exterior walls, windows, doors, exposed floors, main floor header areas and basement ceilings, and foundation walls. The manual concludes with procedures to be followed after the job is completed, to ensure that the sealing of the house does not have adverse affects on the rest of the house system. These procedures relate to combustion venting and indoor air quality. 380 figs., 20 tabs.

6118 **(NECA—TS2-01) Conventional insulation.** (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). 1988. vp. (CE—02035). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $100.00 CAN.

This manual for housing contractors involved in installing conventional insulation begins with a discussion of the house as a system of components, each of which can interact with the other and affect the performance of the whole. Preliminary procedures prior to insulation are then reviewed: inspection, development of an insulation upgrade strategy, job management, customer relations, safety, and selection of tools and materials. Specific procedures are given for insulating accessible attics, non-accessible roofs and attic spaces, half-storey attics, frame walls, solid walls, exposed floors, foundation walls, foundation floors, crawl spaces and slabs-on-grade, and header joist areas. 244 figs., 2 tabs.

6119 (NECA—TS3-01) Windows and doors. (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). 1988. vp. (CE—02036). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $80.00 CAN.

A complete manual is presented on windows and doors for the housing contractor. In order to understand the role of windows and doors in a house's energy performance, an introduction explains the house as a system of components that can have effects on each other. Further chapters explain in detail the parts of a window, window types and RSI values; window servicing and repair; window replacement; parts of a door, door types and RSI values; door service and repair, including weatherstripping; door replacement; and how to ensure quality, service, and customer satisfaction. A glossary of terms is included. 61 figs., 3 tabs.

6120 (NECA—TS4-01) Siding and cladding. (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). 1988. vp. (CE—02037). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $80.00 CAN.

This manual for housing contractors involved in installing siding and cladding begins with a discussion of the house as a complete system, in which the various components of a house interact. Preparatory procedures are given relating to job management, customer relations, and safety. Wall surface assessment and job planning are summarized. Specific procedures are detailed for preparation of wall surfaces and window/door openings, installation of strapping and insulation, application of vinyl, aluminium, and hardboard siding, and soffits replacement. 66 figs., 10 tabs.

6121 (NRC/IRC—8705) A major energy conservation retrofit of a bungalow. Orr, H.W.; Dumont, R.S. (National Research Council of Canada, Saskatoon, Saskatchewan. Inst. for Research in Construction). 1987. 44p. (CE—02090). Institute for Research in Construction, Saskatoon, Sask., Canada S7N 0W9; $N/C.

Construction details are presented for a major energy conservation retrofit of a bungalow. The procedure involved the addition of a well sealed air-vapor barrier to the exterior walls and roof of the house and addition of about 300 mm of glass fibre batt insulation. Insulation was also added to the interior of the basement walls and an additional layer of glass was added to each window. The air leakage of the house as measured by pressure tests was reduced from 2.95 air changes per hour at 50 pascals to 0.29 at 50 pascals, a reduction of 90.1%. Before and after measurements were taken of the space heating requirements of the house. The design heat loss of the house was reduced from 13.1 kW at -34/sup 0/C to 5.45 kW by the retrofit. As the retrofit procedure involved major alterations to the entire envelope of the structure, costs for the total retrofit were high. The total cost for the project, which included upgrading the shingles and the stucco on the house, was $23,700 in 1984 dollars. The energy conservation related costs were $17,200. 4 refs., 15 figs., 3 tabs.

6122 (ORNL/M—648) Building thermal envelope systems and materials (BTESM) and research utilization/technology transfer progress report for DOE Office of Buildings and Community Systems: Monthly progress report. Samples, S.D.; Coleman, G.L. (comps.). (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 56p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004316/JAW.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Program is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting and their evolution over a period of several months.

6123 (ORNL/Sub—84-97333/2) ASTM/DOE Hot Box Round Robin. Bales, E. (Oak Ridge National Lab., TN (USA); New Jersey Inst. of Tech., Newark (USA). Buildings Engineering and Architectural Research Center). Nov 1988. Contract AC05-84OR21400. 93p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004317/JAW.

This report presents the data and data analysis from twenty-one laboratories that completed a series of tests on 4-inch thick specimens of polystyrene in either a guarded or calibrated hot box (ASTM C 236 and C 976). The data analysis resulted in the following recommended precision and bias statements for the two ASTM Standard Test Methods. Measurements from two different laboratories on the same specimen could differ by up to +-7.8% about the mean predicted thermal resistance at a mean temperature of 75 deg F ninety-five percent of the time for the guarded hot box and by up to +-5.6% for the calibrated hot box. Based on guarded hot plate (ASTM C 177) data for the specimen material from the National Bureau of Standards, supported by measurement from other laboratories, the reference value for the specimen material is taken as 15.94 hr-F-ft sq/Btu. The mean of the thermal resistance reported for guarded hot boxes was 15.77 hr-F-ft sq/Btu which differs by -1.07% from the reference value. The mean of the thermal resistance reported for calibrated hot boxes was 16.32 hr-F-ft sq/Btu which differs by +2.38% from the reference value. 22 refs., 5 figs., 2 tabs.

6124 (ORNL/Sub—86-09099/3) A study of radiative heat transfer through foam insulation. Glicksman, L.R.; Torpey, M.R. (Oak Ridge National Lab., TN (USA); Massachusetts Inst. of Tech., Cambridge (USA)). Oct 1988. Contract AC05-84OR21400. 153p. NTIS, PC A08/MF A01 - OSTI. Order Number DE89004318/JAW.

A combination of theoretical analysis and experimental measurement have been utilized to effectively study and improve the thermal performance of foam insulation. A model equation has been developed to effectively describe the heat transfer characteristics of isotropic foams. Heat transfer in foams is separated into three components, (1) conduction through the gas, (2) conduction through the solid polymer, and (3) radiation through the foam medium. The model equation can be modified to account for the anisotropic characteristics of foams. The model equation is developed from the fundamental geometry of the foam, and accurately predicts the experimental data. Radiation heat transfer in foams, accounting for 25% of the total heat transfer, is inversely proportional to the extinction coefficient. The extinction coefficient in foams accounts for the combined effects of scattering and absorption. A simplified model equation has been developed which accurately predicts the value of the extinction coefficient for foams based upon the fundamental geometry. Small flakes, to be suspended within the cell walls, were added to foams to increase the extinction coefficient. The increase in the extinction coefficient is related to the increase in cell wall opacity. Experimental measurements were performed on a series of foam samples of various flake loadings. Results for the extinction coefficient and the overall thermal conductivity as a function of foam geometry and particle loading are presented. The maximum measured reduction in the overall thermal conductivity for a loaded foam sample was found to be 10%. 38 refs., 59 figs.

6125 (SU/ME—14M) Energy efficient housing - a prairie approach. (Saskatchewan Univ., Saskatoon (Canada). Dept. of Mechanical Engineering). 1980. 31p. (CE—02076). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This booklet provides information on a number of practical measures that can be undertaken to conserve energy in houses in the Canadian prairie provinces. It concentrates on improving air tightness, insulation, and passive solar gain, showing how it is possible to reduce average space heating requirements by 90%. Diagrams and explanations are given on the installation of vapor barriers; sealing and weatherstripping; special procedures around doors, windows, vents, and chimneys; construction and installation techniques for insulation of walls, roofs, and floors; utilizing south-facing windows for maximum solar gains; and retrofitting insulation on to exterior walls. Other topics more briefly described are

energy-efficient water heating and energy conservation through optimum usage of electricity. 11 refs., 30 figs., 2 tabs.

3202 Transportation

REFER ALSO TO CITATION(S) 6003

6126 **(DOE/CE/15334—T4) Non-contacting fluid ring seal systems for railcar axle bearing systems: Fifth quarterly report, June 16, 1988--September 15, 1988.** (Ernst Mechanical Industries, Old Saybrook, CT (USA)). Oct 1988. Contract FG01-87CE15334. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003088/JAW.

During this fifth quarter the evaluation of D-size fluid ring sealed roller bearing assemblies was completed with the evaluation of seal configuration MT 3008 and 3016, 3016a and 3016b (different static contact seal concepts), when exposed to intensive dust and rain storms generated within an enclosure surrounding the nondriven side of test rig {number←sign}3 over the entire speed range from 0 to 1220 RPM bearing test speed. During the test rig {number←sign}3 shake down test runs it became apparent that the intensity of the dust and rain storms surrounding the fluid ring sealed bearing end within the "mini" climate chamber could be appropriately observed through small windows at 12:00 and 6:00 o'clock provided in the endwall of the "mini-climate" chamber, rig {number←sign}3 was accordingly modified and the dust and rain exposure tests were conducted at numerous levels of severity. 6 figs.

6127 **(MU/CRT—8703) A multimode multiproduct network assignment model for strategic planning of freight flow.** Guelat, J.; Florian, M.; Crainic, T.G. (Montreal Univ., Quebec (Canada). Centre de Recherche sur les Transports). 1987. 40p. (MICROLOG—88-01665). Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, P.Q., Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Presented in this paper is a normative model for simulating freight flows of multiple products on a multimodal network. The multimodal aspects of the transportation system considered are accounted for in the network representation chosen. The multiproduct aspects of the modal are exploited in the solution procedure, which is a Gauss-Seidel linear approximation algorithm. An important component of the the solution algorithm is the computation of shortest paths with intermodal transfer costs. Computational results obtained with this algorithm are presented. 21 refs., 12 figs.

6128 **(MU/CRT—8708) Communication and transportation networks reliability using routing models.** Sanso, B.; Soumis, F. (Montreal Univ., Quebec (Canada). Centre de Recherche sur les Transports). 1987. 27p. (MICROLOG—88-01668). Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, P.Q., Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A new technology for finding a good measure of reliability in flow networks is introduced. It consists, in its general form, in choosing a good parameter of performance, finding bounds on the expected value of the parameter by partially enumerating the most probable states of the system and, within every state, establishing and solving a routing program. Ways to incorporate this methodology for specific flow networks are shown for every one of the following systems: communications, electric power, vehicular, bus, and air transportation. 10 refs.

6129 **(MU/CRT—8710) Optimal strategies and optimal routes in public transit assignment models: an empirical comparison.** de Cea, J.; Zubrieta, L.; Florian, M.; Bunster, J.P. (Montreal Univ., Quebec (Canada). Centre de Recherche sur les Transports). 1987. 28p. (MICROLOG—88-02274). Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, P.Q., Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A brief review is presented of traffic assignment models for transit networks. Two transit route choice models are evaluated: one that is based on the concept of optimal strategy and the other based on the concept of routes perceived to be minimal. In both models, the transit riders are assumed to select a set of attractive transit lines for their trip from origin to destination; the models differ in the way that this subset of lines is selected. The mathematical formulations and the corresponding solution algorithms are given. The transit flows obtained with these algorithms are then applied to the public transit system of Santiago de Chile, and are compared to the simulated flows. 11 refs., 6 figs., 4 tabs.

6130 **(MU/CRT—8711) Analysis of platoon dispersion with respect to traffic volume.** Baass, K.G.; Lefevre, S. (Montreal Univ., Quebec (Canada). Centre de Recherche sur les Transports). 1987. 22p. (MICROLOG—88-01664). Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, P.Q., Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Traffic signals have the effect of grouping vehicles into platoons which leave the intersection and then disperse. This platoon dispersion phenomenon is an important factor in traffic signal coordination. Platoon dispersion depends on friction. It is hypothesized that this friction can be external and internal and that the internal friction depends on traffic density and volume. Platoon dispersion should consequently be influenced by traffic density and volume. This hypothetical relationship was confirmed by limited field observations and simulations. Platoon dispersion increases with increasing volume up to a maximum value, which is observed at lower volumes than capacity. Dispersion decreases with further increasing volume and becomes nearly zero at volumes near capacity. If further studies confirm the observed relationship, platoon dispersion could be calculated directly from densities or volumes and travel times, applied to Robertson's model on a link by link basis, thus improving the results of traffic signal coordination models. 16 refs., 17 figs., 5 tabs.

6131 **(MU/CRT—8712) NETPLAN: software to aid in decision making for tactical planning of transport operations in the trucking industry.** Delorme, L.; Roy, J. (Montreal Univ., Quebec (Canada). Centre de Recherche sur les Transports). 1987. 17p. (In French). (MICROLOG—88-02269). Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, P.Q., Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper presents the general structure of a tactical tool aimed at assisting motor carriers in the analysis of various operating strategies and network configurations by globally considering the design of the service network of the company and the routing of freight through this network under the double criteria of economic efficiency and service quality. The methodological aspect of the approach is presented, along with some experimental results obtained from various scenario analyses at two large Canadian motor carriers. 13 refs., 1 fig., 1 tab.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 6083, 6144, 6148, 6439

6132 (CPPA/TD—1988) Energy conservation opportunities, 1987. (Canadian Pulp and Paper Association, Montreal, Quebec. Technical Section). 1988. 24p. (In English and French). (CE—02033). Canadian Pulp and Paper Association of Canada, Sun Life Building, 23rd. Floor, 1155 Metcalfe St., Montreal, P.Q., Canada H3B 2X9; $10.00 CAN.

Energy conservation projects in the Canadian pulp and paper industry are listed and described in this document. Projects are classified into categories including thermomechanical pulping, ground wood, paper machines, sulfite and kraft pulping, wood and hog fuel preparation, steam plant, and heating and ventilation. Each project has a description of the project and its results, the costs of implementation, and an address for obtaining additional information. A cumulative index is included which is also useable with previous volumes of this publication.

6133 (DOE/CE/15367—T1) High pressure liquid jet for disintegration of wood: Technical progress report for the period May 1988--September 30, 1988. (Incubator Technologies, Inc., Rolla, MO (USA)). 1988. Contract FG01-88CE15367. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003391/JAW.

Most newsprint is made of a mixture of seventy to eighty percent ground wood, and twenty to thirty percent unbleached sulphite or semi-bleached sulphate pulp. Presently, spruce is the most desirable species for wood pulp production, with the true firs, western hemlock, and southern pine following in order. It is anticipated that the use of hardwoods in newsprint will increase with time. In the manufacture of wood pulp for paper production, conventional practice is to grind debarked logs using a revolving grindstone. The abrasive stone causes individual wood fibers and fiber bundles to be separated from the log. Water is added to the ground pulp, during grinding, through a shower pipe which sprays water on the periphery of the stone. This water adsorbs the frictional heat generated at the interface between the stone and the wood, washes the fibers from the surface of the stone, and controls the consistency of the resulting pulp. 6 refs., 2 figs., 2 tabs.

6134 (DOE/EIA—0512(85)) Manufacturing energy consumption survey: Consumption of energy, 1985. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 18 Nov 1988. 123p. NTIS, PC A06/MF A01 - GPO - OSTI. Order Number DE89003384/JAW.

In recent years, industrial consumption of energy in the United States has been declining despite increasing industrial output. Nevertheless, total net energy consumption by the entire industrial sector was 20.4 quadrillion Btu (quads) in 1985, which was 37 percent of the US total for the residential, commercial, transportation, and industrial sectors. A clearer understanding of how energy is used in the industrial sector can help the Nation anticipate how future expansion of and change in the US industrial base might affect future energy requirements. The Manufacturing Energy Consumption Survey (MECS) is designed to contribute to this understanding. This report, the first of a series based on the 1985 MECS, provides a comprehensive description of energy consumption by manufacturing industries in the United States. The MECS is the first survey conducted by the Energy Information Administration (EIA) to collect detailed data on energy use by manufacturing industries. The MECS does not include energy consumption by mining, agriculture, construction, and electric utilities. Energy consumption by manufacturers is approximately 80 percent of the consumption of the entire industrial sector. 55 refs., 7 figs., 31 tabs.

6135 (DOE/ID/12296—4) High temperature burner-duct-recuperator system evaluation: Fourth annual report, October 1984--September 1985. (Babcock and Wilcox Co., Lynchburg, VA (USA). Research and Development Div.). 1985. Contract FC07-81ID12296. 54p. NTIS, PC A04/MF A01 - OSTI; 1; GPO Dep. Order Number DE88013692/JAW.

The B&W design uses a tube-in-tube bayonet style in the ceramic heat exchanger. This system is describe in detail in the previous annual reports. Basically, the ceramic stage consists of fifty outer tubes of siliconized silicon carbide; fifty inner tubes (twenty-five recrystallized silicon carbide on the hotter end and twenty-five metallic tubes on the cooler end); two metallic tubesheets insulated with Koawool fiberglass insulation; and associated seals and support sleeves. The sleeves provide support for the tubes but are resilent enough to adjust for thermal expansion. The seals prevent air movement between the combustion air and flue gas streams. In operation, combustion air is driven by a large fan into the metallic heat exchanger, where some heating occurs. Air is then directed through ducting to the ceramic heat exchanger, where maximum preheat occurs. The air moves into the upper plenum, down through the inner tubes, up through the space between tubes, and exits through the lower plenum. Preheated air then moves through larger insulated ducts to the burner. Spent flue gas exits the pit and moves down the flue through first the ceramic tubes and then the metallic tubes before exiting past the damper and out the stack. Benefits of the design concept includes: no dilution air required; high operating temperature; low flue side pressure drop; unconstrained structural ceramics; and ease of maintenance. 39 figs., 1 tab.

6136 (IFP—36-012) Optimal management of an industrial energy network. Bloch, M. (Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France)). 1987. 278p. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88755601/JAW.

Main characteristics of energy consumption in industry are studied, evidencing the prime importance played by the energy network especially in petroleum refining. Choice of an optimization algorithm is examined for comparison with systems already developed. Then the system OPERA (Optimization of energy in refineries) is outlined. The developed software is described. The solution is obtained from a serie of linear problems representing successive approximations of the non linear initial problem.

6137 (KCP—613-4025) Manufacturing and the manufacturing engineer in the year 2000. Gillespie, L.K. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Nov 1988. Contract AC04-76DP00613. 24p. (CONF-8810260—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003461/JAW.

From CAM-I annual technical conference; San Francisco, CA, USA (17 Oct 1988).

The following paragraphs provide a look at part of the future and what it may mean to manufacturing engineers. It is based on a review of many publications, personal experiences in robotics, FMS planning, education, and four years' participation in CAM-I's Advanced Technical Planning Committee. The committee provided a great training ground and test-bed for ideas. The participants in this CAM-I group brought a variety of experiences from the forefront of CIM endeavors. Many of the CAM-I participants and outside speakers brought years of unique experience and insight. Some fellow employees also provided new visions of the future. A look at internal company long-term needs and participation in SME's study of the future of manufacturing engineering, provided more research and other forums to further explore the future. 29 refs.

6138 (OH/CR—87-184-K) Coal ash as structural fill with special reference to Ontario experience. Toth, P.S.; Chan, H.T. (Ontario Hydro, Toronto (Canada). Civil Research Dept.). 1987. 46p. (MICROLOG—88-01716). Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., Canada M8Z 5S4; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Fly ash and bottom ash obtained from coal-fired generating stations can be used as alternatives to natural materials for the construction of structural fills. The relevant engineering properties of coal ash are discussed in the context to their expected behaviour in structural fills. Four case studies of fly ash used as structural fill in Ontario are presented to demonstrate that the physical behavior of fly ash is similar to that of silt and that can be handled with similar

methods. The performance of fly ash structural fills were evaluated during and after construction. Groundwater monitoring data from existing fly ash fills are presented to show that ash leachate migrating in the groundwater regime has minimum impact on groundwater quality. Data are presented which show that corrosion of metal services in ash should not be a concern. Ash leachate was found not to be detrimental to good quality concrete structures. 26 refs., 13 figs., 14 tabs.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 5939, 5944, 6439

6139 **(CONF-8809180—1) Defining appropriate roles for electric utilities in demand-side management: A summary of workshop issues.** Hirst, E. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89002317/JAW.

From Workshop on conservation programmes for electric utilities; Paris, France (21 Sep 1988).

The International Energy Agency workshop on Conservation Programmes for Electric Utilities included 27 presentations and discussions among experts from about 20 different countries. These experts were from electric utilities, government agencies, associations, universities, and other research organizations. It would not be feasible to summarize each talk and the accompanying discussion in this paper. Rather, my purpose here is to present what I saw as the primary themes raised during the three-day conference. Therefore, this paper covers three topics: conclusions with which conference participants appeared to agree, areas of disagreement, and important unresolved issues. Finally, I give my impressions of progress among electric utilities in the United States relative to that within the other IEA countries. 3 tabs.

6140 **(DOE/CE/26553—T2) District Heating and Cooling Feasiblity Study, Salt Lake City, Utah: Final report.** (Burns and Roe, Inc., Oradell, NJ (USA)). 9 Sep 1988. Contract FG01-86CE26553. 166p. NTIS, PC A08/MF A01. Order Number DE89003051/JAW.

The following is a general description of the Burns and Roe study of District Heating and Cooling Feasibility for Salt Lake City, Utah. The study assesses District Heating and Cooling (DHC) and develops a conceptual district system for Salt Lake city. In assessing District Heating and Cooling in Salt Lake City, the system conceived is evaluated to determine whether it is technically and economically viable. To determine technical viability, aspects such as implementation, pipe routing, and environmental restrictions are reviewed to foresee any technical problems that would arise as a result of DHC. To determine economic feasibility, the conceived system is priced to determine the capital cost to construct, and modeled in an economic analysis using anticipated operating and fuel costs to produce the required revenue necessary to run the system. Technical and Economic feasibility are predicated on many variables, including heating and cooling load, pipe routing, system implementation, and fuel costs. These variables have been investigated and demonstrate a substantial potential for DHC in Salt Lake City. Areas of consideration include the Downtown Area, Metropolitan Hall of Justice and surrounding area, and the Hotel District.

6141 **(DOE/CE/26567—T1) Btu flow rate meter proof of concept demonstration for district heating and cooling systems: Final technical report.** Mawardi, O.K. (Babcock and Wilcox Co., Barberton, OH (USA)). Oct 1988. Contract FG01-86CE26567. 40p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003396/JAW.

This report describes a research effort devoted to the development and subsequent feasibility demonstration of an instrument for the remote sensing of the Btu flow rate in a steam or hot water heating system. The concept of the Btu meter is based on a differential hot wire anemometer invented by Osman K. Mawardi. The incentive in the development of this device is the increased demand for an inexpensive and accurate (better than 1%) Btu meter. The ability of the meter to be read remotely is essential, since it is an effective way of reducing the manpower costs of the company operating the heating system. Other features of the Btu meter which are included in the design are simplicity of construction, ruggedness, and flexibility of the electronic interfacing system. The latter feature permits the incorporation of the telemetering circuit in a telephone or radio-based communication system. Both of these alternatives are commercially available today and are quite economical. With small modifications of the interfacing circuitry, the meter can be linked to a fiber optics automated meter reading network. 15 refs., 20 figs., 1 tab.

6142 **(EMR—MG9979) Study into the economic viability of district heating for the central area of the city of Winnipeg. Vol. 1.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada); Manitoba Ministry of Energy and Mines, Winnipeg (Canada)). 1985. 93p. (CE—02080). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A feasibility study was conducted to address the viability of a new district heating facility in Winnipeg. This facility would burn municipal wastes and would enable expansion of the present coal-fired system. In an evaluation of potential markets, sales were projected to be about 1.4 million GJ/y in 1990 with steam prices to be set below prices from competing energy sources. The quantity of municipal waste available to fuel the plant was established, and used as an input to sizing the plant. Burning such wastes provides an economic benefit in the form of reduced waste hauling costs, and this benefit was included as part of the anticipated revenue. Auxiliary fuels were studied to determine their price and availability during peak winter demand. A number of combinations of technology options, heating loads, plant sizes and sites were examined and the chosen design consists of three mass-burning units which avoid fuel preparation steps; each unit is intended to operate 7500 h/y y with the rest of the year occupied by scheduled cleaning and maintenance. Based on the customers identified in the market studies, extensions to the existing steam distribution network were designed. Examination of environmental concerns showed that the plant could be operated without adverse impacts. Assessment of project economics, based on a discounted cash flow analysis, showed that the project is economically viable. Sensitivity analysis to variances in input data indicated that while steam revenues and capital costs have the greatest impact on project returns, the project is not radically sensitive to moderate changes in any one variable. 17 figs., 7 tabs.

6143 **(EMR—MG-11912) Winnipeg district heating study. Phase 1.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada); Manitoba Ministry of Energy and Mines, Winnipeg (Canada)). 1984. 102p. (CE—02081). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This study determines whether potential markets exist for the expansion of the existing Winnipeg district heating system and whether they can be served at an acceptable price. A survey, covering the city center, and the adjoining industries and institutions, indicated a total market of 1,465 million lb of steam/y. The market can be developed at a savings of 20% of the existing fuel cost. The proposed system uses municipal solid waste (MSW) as the primary fuel and coal as the winter peaking fuel. The existing distribution system is to be upgraded and expanded to serve the new markets. Capital cost of the new facilities and modifications is estimated at $100 million and operating costs at $6.4 million/y. For this assessment, it has been assumed that the plant wil be located at a city-owned site. Generation of electrical energy using excess steam during the summer appears to be uneconomical and this low-cost excess will be available for future industrial growth. Net present value of all costs for the base case is $175 million and value of benefits $226 million. Benefits considered in this analysis include steam revenue, savings because of the retention of the existing system, a lower steam cost for the new system and a reduction in MSW hauling and landfill requirements. Plant revenues are based on a steam price of $6.13/1000 lb for industrial users and $6.74/1000 lbs for space heating; these prices are substantially lower than existing prices, and will result in a net reduction in energy costs for customers. 8 figs., 8 tabs.

6144 **(EPRI-EM—6096) Congeneration and utilities: Status and prospects: Final report.** Limaye, D.R.; Jacobs, L.; McDonald, C. (Electric Power Research Inst., Palo Alto, CA (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA)). Nov 1988. 106p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003831/JAW.

The cogeneration industry has grown and changed considerably since the passage of the Public Utility Regulatory Policies Act (PURPA) in 1978. It has moved from infancy to a major industry that must be addressed in electric utility resource planning. This report examines the utility perspective on cogeneration. The report begins with a brief outline of the history of the US cogeneration industry, including an in-depth look at recent developments. An assessment of the industry as it currently stands is then presented. This assessment includes a look at who is cogenerating now and who is likely to be cogenerating in the future. It also includes an analysis of the key market sensitivities and how they affect the individuals who must make the decisions to cogenerate. These discussions provide a framework for the central issue addressed in the next section: the effect of cogeneration on the electric utilities. After the alternative responses to cogeneration are outlined, the report details the impacts of cogeneration on utility planning and policy. Special utility concerns relative to cogeneration are raised including potential ratemaking approaches, the issue of cogeneration reliability and approaches to planning for it, and the costs and benefits of cogeneration to non-participant ratepayers. Next the planning and economic benefits which can accrue from utility ownership of and participation in cogeneration projects are discussed in the context of cogeneration as an electric utility opportunity. The final sections of the report define and classify various types of cogeneration technologies and outline the current status of EPRI's cogeneration research. 21 figs., 22 tabs.

6145 **(EPRI-EM—6102-Vol.1) COGENMASTER: A model for evaluating cogeneration options: Volume 1, Functional description: Final report.** Balakrishnan, S.; Limaye, D.R.; Ross, C.; Gavelis, B.; Scott, S. (Electric Power Research Inst., Palo Alto, CA (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA)). Dec 1988. 128p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004134/JAW.

The COGENMASTER model was developed in this project. COGENMASTER is a micro-computer based menu-driven model which enables the user to examine the technical aspects of various types of cogeneration projects, evaluate their economic feasibility, and prepare detailed cash flow statements that spell out the costs and benefits to project participants. The model is designed to objectively evaluate and screen cogeneration options by comparing them to a base case scenario in which electricity is purchased from the utility and thermal energy is produced on-site. The model consists of many modules that may be individually edited. The different modules that constitute COGENMASTER are the technology, load shape, rates, sizing, operating, cash-flow, financing, pricing and simulation modules. A load shape library of electric and thermal loads in nine commercial buildings and seven weather zones was also developed as part of this project. In addition, a technology database of six generic cogeneration systems is also included in the package. The model has been written for IBM-PC compatible computers with 512K memory, a floppy drive and a hard disk. 20 figs., 11 tabs.

6146 **(EPRI-EM—6102-Vol.2) COGENMASTER: A model for evaluating cogeneration options: Final report, Volume 2, User's guide.** Balakrishnan, S.; Limaye, D.R.; Ross, C.; Gavelis, B.; Scott, S. (Electric Power Research Inst., Palo Alto, CA (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA)). Dec 1988. 165p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89004132/JAW.

The COGENMASTER model was developed in this project. COGENMASTER is a micro-computer based menu-driven model which enables the user to examine the technical aspects of various types of cogeneration projects, evaluate their economic feasibility, and prepare detailed cash flow statements that spell out the costs and benefits to project participants. The model is designed to objectively evaluate and screen cogeneration options by comparing them to a base case scenario in which electricity is purchased from the utility and thermal energy is produced on-site. The model consists of many modules that may be individually edited. The different modules that constitute COGENMASTER are the technology, load shape, rates, sizing, operating, cash-flow, financing, pricing and simulation modules. A load shape library of electric and thermal loads in nine commercial buildings and seven weather zones was also developed as part of this project. In addition, a technology database of six generic cogeneration systems is also included in the package. The model has been written for IBM-PC compatible computers with 512K memory, a floppy drive and a hard disk.

6147 **(NP—9770122) Steps taken, during the construction of incinerator number 6 to reduce the corrosion and develop a quasi-dry waste-gas-cleaning system for the waste incineration plant Duesseldorf. Final report.** Bewerunge, J.; Kassebohm, B. (Stadtwerke Duesseldorf A.G. (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). [1988]. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770122/JAW.

Before the construction of the sixth incineration furnace, corrosion was intensively studied and steps were taken in the planning and building of the incinerator to reduce the corrosion to a minimum. The foundation for our study was gathered from literature; evaluations of corrosion damage in specific waste incineration plants. Also scale trials were carried out using different materials and construction parts under normal conditions in existing incinerators. After the incinerator had been put into service, the air, fuel and fireing was adjusted to give a optimal performance rate. The waste gas incineration plant was fitted out with a half-dry waste-gas cleaning-system. This system has the advantage that it needs a small development area; there is not waste water; the waste-gas temperature does not have to be increased for the cleaning of the waste gas; it is economically efficient; and shows certain advantages when being fitted into existing plants. Through the study construction and special development of jet nozzles and a wall cleaning system it was possible to obtain a high SO/sub 2/ reduction rate and a long service quality.

6148 **(NP—9770134) Renovation and consolidation of the MHKW Iserlohn with a flue gas scrubber, additional plants and enlargement of the district heating system. Final report.** Reitz, P.; Schroeder, M.; Guennemann, H. (Maerkischer Kreis, Iserlohn (Germany, F.R.). Amt fuer Abfallbeseitigung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1987. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770134/JAW.

Into the existent plant MHKW Iserlohn a wet gas cleaning system had been installed after the E.-filters during working of the power plant. The limiting values of the TA Luft for HCl, F and dust will be kept surely. The exploitation of the heating system was improved by installation of a draw-off condensation turbine of 6 MW and better heat exchangers.

6149 **(SERI/SP—320-3341) Energy conservation technical information guide: Volume 2, Utilities.** (Solar Energy Research Inst., Golden, CO (USA)). Aug 1988. Contract AC02-83CH10093. 71p. NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI88001174/JAW.

This document is the second volume of a set of energy-conservation technical information guides (TIGs) designed to help you find information about conservation technologies. It is written for several audiences, including scientists and engineers, university researchers, manufacturers, and utility policy-makers and planners. The first document of the series, entitled {ital Energy Conservation Technical Information Guide, Volume 1: Resource Directory}, lists primary research and related activities. The directory includes organizations involved with the federal conservation research program and other similar efforts. Work in commercial and residential energy conservation is described in the {ital Energy Conservation Technical Information Guide, Volume 3: Buildings}. This set of TIGs is a joint effort of the Department of Energy (DOE) Office

of Buildings and Community Systems (OBCS), and the Western Area Power Administration (Western), one of the five power marketing administrations within DOE.

3209 Education And Public Relations

6150 (EMR/CRE—EL87-10) Energy management for the future. A sourcebook of ideas and activities for energy conservation learning programs. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Conservation and Renewable Energy Branch). 1980. 132p. (CE—02088). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This book serves as a teaching aid for Canadian school programs in energy conservation and energy management. Suitable curriculum areas and objectives are outlined, and suggestions are presented for organizing thematic study units. References are made throughout to appropriate use of additional media such as filmstrips. Five study units, each with its own classroom activities, are detailed: energy resources, energy and the home, energy and food, energy and leisure, and energy in transportation. Suggestions are given for ongoing energy management educational programs to be tried out once the study units have been completed. 23 figs.

6151 (EMR/PE—50/1983) Evaluation of the Canadian Home Insulation Program (CHIP). (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Program Evaluation Branch). 1983. 75p. (CE—02073). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The CHIP program was instituted to reduce space heat consumption in existing dwellings in Canada and to upgrade, to at least a basic level of thermal efficiency, the 70% of the housing stock in Canada in greatest need of improvement. An evaluation of this program was undertaken to fulfill the following objectives: to examine the continuing need for insulation programs such as CHIP; to examine, and suggest programs for, action to benefit non-participating classes of housing units; to outline the progress achieved to date in implementing the program, measured against the original program objectives; and to review the cost effectiveness of the processing of CHIP applications. The study also included a data collection and analysis for the purposes of policy planning and program development for the residential sector. Data were collected through house inspections, questionnaires, and interviews. Some conclusions of this evaluation are as follows. The program's targets were ambiguously stated and unrealistic; participation in the program could increase if awareness were increased in certain regions and among lower socioeconomic groups. CHIP has been used primarily for attic insulation and, combined with other factors, has led to energy savings below target. The program has induced a significant number of homeowners to take insulation action, and the potential for energy savings is still large. CHIP program delivery is not as cost effective as it could be; the computer operations need considerable improvement. Achieved energy savings have been economically efficient, and the program shows a good benefit-cost ratio. 15 refs., 5 tabs.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 5795, 6157

6152 (DOE/MC/21384—2528) Combustion characteristics of coal fuel in adiabatic diesel engines: Final report. Likos, W.E.; Ryan, T.W. III. (Southwest Research Inst., San Antonio, TX (USA). Fuels and Lubricants Research Div.). Aug 1987. Contract AC21-84MC21384. 308p. NTIS, PC A14/MF A01 - OSTI. Order Number DE88001021/JAW.

The combustion of 50 wt % coal slurries, using water, diesel fuel, and methanol as carrier liquids, was investigated in a single-cylinder research engine. Preliminary data on the engine performance of dry powder coal, injected at high pressure into the engine, were also obtained. High temperatures were achieved in the engine cylinder using low-heat rejection engine technology, electrically heated glow plugs, and heated inlet air. Five coal-derived liquids, representing various low-cost processing technologies, were also evaluated for potential use as fuels in a variable compression ratio single-cylinder engine. Comparisons of the different fuels and methods of providing additional cylinder heat were obtained from cylinder pressure data and heat release calculations. Conclusions are: Autoignition of coal/water and coal/diesel slurries are possible in a medium speed diesel engine. Burning rates of the autoignited slurries could be significantly enhanced by a pilot injection of diesel fuel. Thermal efficiencies of the coal/water slurry equaled the base diesel fuel under some conditions. Engines designed for coal slurry should have the prechamber volume maximized. The Great Plains Naphtha is the best selection as a diesel fuel blending stock of the fuels tested when the ease of blending into diesel fuel, and engine performance are considered. 27 refs., 80 figs., 21 tabs.

6153 (NP—9770147) Investigation of the performance characteristics of a methanol-vapour-fueled spark ignition engine for commercial vehicles. Scholten, J. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 15 Sep 1986. 109p. (In German). NTIS (US Sales Only),, PC A06/MF A01. Order Number DE89770147/JAW.

An engine concept is described in which methanol vapour generated by means of the cooling water heat is used as fuel. The available alternative fuel technologies for diesel and spark ignition engines are described and the experimental programme and its results are presented. The methanol vapour and methanol injection techniques are compared, and the influence of constructional parameters on engine performance and cold starting characteristics with methanol vapour fuel is investigated. The author considers the methanol vapour fuel concept as a viable alternative in diesel fuel substitution, both in terms of performance and pollutant emissions. (HWJ).

6154 (ORNL/CON—267) Technical accomplishments of DOE's Office of Transportation Systems. Snell, S.A.; Brown, M.A.; Davis, S.C. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 117p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89004313/JAW.

This report describes the technical accomplishments of the US Department of Energy's Office of Transportation Systems (OTS). Information on technical accomplishments was collected as a basis for developing an effective technology transfer plan and identifying new technologies and achievements which may become the subject of future technology transfer efforts. Some of these accomplishments are now commercialized technologies; others are technological advancements that are not yet in the market. The accomplishments also include design tools, testing procedures, and standards that facilitate the transfer of OTS-supported products to the private sector; research facilities that support the development of advanced technologies and facilitate their transfer; and spin-off applications. More than 80 individual technical accomplishments are documented in the report's appendix. 9 refs., 4 figs., 2 tabs.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 6154

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 6069, 6154

3306 Vehicle Design Factors

6155 (NP—9770148) Modelling and simulation of a vehicle drive with continuous hydrostatic power shift gear. Vonnoe, R. (Bochum Univ. (Germany, F.R.). Lehrstuhl fuer Mess- und Regelungstechnik). 6 Feb 1986. 143p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770148/JAW.

The study comprises a theoretical systems analysis and the development of mathematical models for a vehicle drive with hydrostatic power shift gear. It describes the modelling of the drive components, internal combustion engine, centrifugal clutch, drive, and vehicle. The problems and implementation of real-time analog computer simulation are discussed, and simulation results are presented. With the possibility of real-time simulation, the model is a useful aid in the development of an optimum vehicle drive control system. (HWJ).

3307 Emission Control

6156 (EPS—EPS2/TS/16) Vehicle emission control system tampering. Cope, D. (Environnement Canada, Ottawa, Ontario. Conservation et Protection). 1988. 34p. (In French). (MICROLOG—88-03673). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Tampering with a vehicle's emissions control systems can lead to the emission of hydrocarbons (HC), CO, and NO/sub x/ far in excess of the manufacturer's design levels or legislated standards. Misfuelling a vehicle with leaded fuel, a form of tampering, will not only result in increased HC, CO and NO/sub x/ emissions (from a three-way catalyst equipped vehicle) but will also result in increased and unnecessary lead emissions to the environment. Data from random vehicle surveys in the USA and voluntary inspection clinics in Canada reveal that tampering, in one form or another, is chronic and can be found on 20 to 50% of the vehicles operating on the roads and highways. Tampering is most common in older model vehicles. The excess emissions from these tampered vehicles contribute to the already heavy loading of CO, NO/sub x/ and ozone with burden many of Canada's urban environments. These excess vehicle emissions are even more disturbing since they need not occur. A properly maintained and fuelled vehicle is designed to keep fuel economy and emissions at optimum levels for its useful life. Tampering usually occurs because of mistaken impressions that such actions will improve driveability of reduce vehicle operating expenses. Inadvertent tampering may occur because of insuffcient vehicle maintenance which leads to component deterioration. For attempting to correct the problem of excess vehicle emissions by reducing the incidence of tampering, phased approach is suggested. The first steps are a public information campaign and an education program which includes vehicle mechanics and dealers. It is suggested that these programs be accompanied by provincial anti-tampering/anti-misfuelling legislation. Local agencies should investigate compulsory vehicle inspection and maintenance programs and consider the implementation of such programs in problem areas. 14 refs., 1 fig., 10 tabs.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 6152, 6153, 6154

6157 (ORNL/TM—10816) Results from the first year of operation of the Federal Methanol Fleet at Argonne National Laboratory. McGill, R.N.; Hillis, S.L.; Larsen, R.P. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 55p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004307/JAW.

The Oak Ridge National Laboratory, under the auspices of the Department of Energy's Alternative Fuels Utilization Program, has managed the Federal Methanol Fleet Project since its inception in fiscal year 1985. This congressionally-mandated project directed the Department of Energy to introduce methanol-fueled vehicles into civilian government fleet operations. This interim report describes the first year of operation of a methanol fleet at Argonne National Laboratory in Argonne, Illinois. The fleet consists of five methanol-fueled 1986 Chevrolet S-10 pickup trucks along with five Chevrolet S-10s for comparison, as well as five methanol-fueled 1986 Ford Crown Victorias paired with four gasoline Fords. Data have been collected and tabulated on fuel consumption, maintenance records, oil sample analyses, and driver perceptions of vehicle operability. Energy efficiency for the methanol vehicles was slightly greater than that for the counterpart gasoline vehicles. Maintenance records reveal that the methanol vehicles required substantially more service than the gasoline vehicles, but a large proportion of the difference was due to methanol component replacements where improvements or upgrades were scheduled to be implemented after the vehicles were in service. Oil sample analyses revealed that engine wear rates were higher in the methanol vehicles. Drivers indicated that the methanol vehicles are quite acceptable, but they rated the gasoline vehicles higher. The Argonne fleet serves as the cold-weather site of the Federal Methanol Fleet and, as such, the methanol vehicles have been outfitted with special systems to aid in cold-starting and driveability.

6158 (OTC—NG-84-02) Natural gas as an automotive fuel. An analysis of the consumers' gas demonstration program. Topaloglu, T. (Ontario Ministry of Transportation and Communications, Ottawa (Canada); Ontario Ministry of Health, Toronto (Canada)). 1985. 46p. (CE—02045). Ontario Ministry of Transportation and Communications. Transportation Technology and Energy Branch, 1201 Wilson Ave., Downsview, Ont., Canada M3M 1J8; $N/C.

The technology and economics of natural gas fuel in Ontario were demonstrated. A compressed natural gas (CNG) fuelling station was built and 22 service vans were converted to operate on a CNG/gasoline dual-fuel mode. The operation of the station and fleet was assessed and reported on over a one-year period. The fuel efficiency of the fleet, the operation of the station and fleet along with the economics of CNG utilization were the specific areas in which data were obtained. The program showed that, with presently available equipment, CNG can be beneficially used as a vehicle fuel in Ontario. However, improvements are needed in a number of areas in order to enhance market acceptability and energy utiization efficiency. The main conclusions of this work include the following. In a service fleet operation involving urban driving conditions with prolonged idling periods, fuelling of spark-ignition engines with either CNG or gasoline results in comparable energy utilization efficiencies. Large variations in relative fuel efficiency may arise from differences in the pre-conversion state of the vehicles and the conversion process. The average CNG consumption was 27.2 m/sup 3//100 km, whose monthly variation correlated well with ambient temperature. The use of CNG appears to provide a potential for doubling engine oil life. Deficiencies in CNG vehicles included poor cold-weather startability, rough engine idling and 20% reduction in acceleration performance. The cost benefit data indicate that, under the present pricing and incentive structure, the use of CNG as a vehicle fuel is very economical in Ontario. 11 refs., 6 figs., 8 tabs.

35 ARMS CONTROL

3501 Policy, Negotiations, And Legislation

6159 (IAEA-INFCIRC—353) Text of the joint USSR-USA statement following the summit meeting in Moscow, 29 May - 2 June 1988. (International Atomic Energy Agency, Vienna (Austria)). Jun 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704456/JAW.

Hard copies are available in English and Russian from IAEA Division of Publications, Distribution Unit.

The document reproduces the text of the joint USSR-USA statement following the summit meeting between the President of the United States, Ronald W. Reagan and the General Secretary of the Central Committee of the Communist Party of the Soviet Union, Mikhail S. Gorbachev, held in Moscow between May 29 - June 2, 1988. It refers to the arms control (including nuclear weapons), human rights and humanitarian concerns, regional issues, bilateral affairs and further meetings.

6160 (IAEA-INFCIRC—355) Statements commemorating the twentieth anniversary of the Treaty on the Non-Proliferation of Nuclear Weapons. (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704458/JAW.

Hard copies are available in English, French, Russian and Spanish from IAEA Division of Publications, Distribution Unit.

The document reproduces the following statements commemorating the twentieth anniversary of the Treaty on the Non-proliferation of Nuclear Weapons: Statement by the Secretary-General of the United Nations, statements on behalf of the depository Governments and statements on behalf of other Governments (Australia, Bangladesh, Canada, Costa Rica, Cyprus, Czechoslovakia, Egypt, Federal Republic of Germany, Greece, Hungary, Ireland, Japan, Liechtenstein, Mexico, the Netherlands, New Zealand, Solomon Islands, Spain, Sri Lanka, Switzerland, Thailand, Trinidad and Tobago, Western Samoa and Nordic Countries - Denmark, Finland, Iceland, Norway and Sweden).

6161 (IAEA-INFCIRC—356) Letter to the Director General from representatives of the Depository Powers for the Treaty on the Non-Proliferation of Nuclear Weapons. (International Atomic Energy Agency, Vienna (Austria)). Aug 1988. 1p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704459/JAW.

The document reproduces a letter to the Director General of the IAEA from representatives of the Depository Powers for the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) as a result of their discussion with representatives of the Republic of South Africa concerning its accession to the NPT.

36 MATERIALS

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 5813, 5814, 5975, 5987, 5988, 5989, 7114

6162 (CEA-CONF—9408) Stress corrosion of the alloy U-6 Nb. Brunet, H.; Nomine, A.M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). Oct 1987. 4p. (In French). (CONF-8710255—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755602/JAW.

From Autumn metallurgy meeting; Paris, France (20 Oct 1987).

This work describes stress corrosion behavior in oxygen and hydrogen. Embrittlement mechanisms are studied and influence of temperature, pressure and nitrogen are examined.

6163 (CEA-CONF—9444) Effect of neutron radiation on mechanical properties of permanent near core structures. Tavassoli, A.A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 19p. (CONF-880613—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755605/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, United States (27 Jun 1988).

Several hundred specimens have been tested in order to assess the effects of low dose neutron radiation (<1 dpa or <1 appm He) on mechanical properties of near core permanent structures of fast breeder reactors. The experiments include irradiations in fast and thermal reactors from a few days to well over 15 years. A particular attention has been given to correlation between service conditions and irradiation parameters, such as: temperature, time, dose, dose rate, spectrum and sodium environment, as well as to materials requirements through utilization of nuclear grade welded plates of stainless steel types 304L and 316L-SPH. Post irradiation properties measured are tensile, instrumented charpy (U and V notches), fracture toughness (J-R curves), fatigue and fatigue-creep testing. Neutron metrology has been performed with conventional detectors amongst the specimens and in some cases with parallel irradiation of heavy isotope detectors in adjacent reactor sites. For lower core structure, where operating temperature is about 400/sup 0/C and ductility and toughness are primary design concerns, the changes provoked, by doses up to 1.3 dpa, in overall mechanical properties of welded joints are small. For upper core structure, where the operating temperature is about 550/sup 0/C and fatigue and creep resistance are major design needs, the changes induced, through formation of up to about 2 appm helium, in conventional fatigue properties or fatigue with short hold times are negligible. With increasing hold time, intergranular rupture in irradiated specimens is enhanced but the limited number of tests does not allow definite conclusions to be drawn. 53 refs, 3 tabs, 9 figs.

6164 (CEA-CONF—9464) Laser quenching of zircaloy 4 tubes. Charissoux, C.; Richard, A.; Darchis, L.; Contre, M.; Mardon, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie; Fragema, 69 - Lyon (France)). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). Sep 1988. 9p. (In French). (CONF-880922—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755608/JAW.

From 4. international symposium on welding and melting by electron and laser beams; Cannes, France (26 Sep 1988).

Surface quenching treatments by CO/sub 2/ laser made on zircaloy 4 tubes, guarantee treated depths of about 60 μm, corresponding to 1/10 of the tube thickness. The metallurgical characterization shows the martensitic structure of the transformation after quenching, without recrystallization of the cold worked and stress-relieved underlying metal. Different types of treatment have been also achieved on the total thickness of the tubes. The mechanical characterization of the treated samples indicates that the surface treatment is the only one which does not involve major modifications of the usual mechanical properties of the tubes. The carrying out of the study concerns the feasibility tests of the surface treatment using a local gas shielding system. 10 figs.; 7 refs.

6165 (CEA-CONF—9469) Behavior and microstructure of ferritic steels irradiated in the Phenix reactor. Gilbon, D.; Seran, J.L.; Cauvin, R.; Fissolo, A.; Alamo, A.; Le Naour, F.; Levy, V. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). Jun 1988. 36p. (CONF-880613—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755453/JAW.

From 14. international symposium on effects of radiation on materials; Andover, MA, United States (27 Jun 1988).

This paper deals with the irradiation behavior of three ferritic steels, namely F17 (17Cr), EM12 (9Cr-2MoNbV) and EM10 (9Cr-1Mo). These alloys were irradiated up to 100 dpa in Phenix as samples or wrapper tubes. The immersion density measurements confirm their high swelling resistance, but the tensile and impact tests reveal great differences in their mechanical properties. The DBTT of F17 is strongly increased, and compared to an aging treatment the irradiation amplifies and shifts its embrittlement to-

wards the low temperatures. In contrast to F17, the mechanical properties of EM10 are nearly not affected by irradiation, and EM12 has an intermediate behavior. The TEM examinations show that all the small density variations come from irradiation-induced voids and that the F17 embrittlement results from α 'phase formation enhanced by irradiation. In conclusion, EM10 is by far the most attractive candidate for wrapper applications. Its fully martensitic structure implies an improved swelling resistance and its chemical composition should inhibit the microstructural instabilities which are responsible of the embrittlement of F17 and EM12.

6166 **(CEA-CONF—9624) Effects of neutral gas incorporation in molybdenum coatings, produced by magnetron sputtering.** Bosland, P.; Danroc, J.; Gillet, R.; Lombard, L. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie). Mar 1988. 12p. (CONF-880488—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755621/JAW.

From 15. international conference on metallurgical coatings; San Diego, CA, United States (11 Apr 1988).

Molybdenum coatings were produced by planar magnetron sputtering, using argon or neon as discharge gas. With argon, the hardness of the molybdenum layers was found to increase with the bias voltage applied to the substrate, up to values of 16000 MPa (HV 0.05) for -600 V. The hardness of the layers produced using neon is also high - 15000 MPa (HV 0.05) - but it is independent of the bias voltage. These hard layers contain argon or neon, are highly textured and present very high residual stresses in compression. A chanelling effect of the incident energetic particles is taken into account to explain the occurrence of the (111) texture. Hardening seems to depend more on the mechanisms involved in the incorporation of the neutral gas than on the actual gas content.

6167 **(CONF-890103—2) Thermomechanical processing of tantalum alloy ASTAR-811C.** Sikka, V.K. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89002216/JAW.

From 6. symposium on space nuclear power systems; Albuquerque, NM, USA (9 Jan 1989).

This paper presents preliminary results of the thermomechanical processing of scaled-up quantities of the high-strength tantalum alloy, ASTAR-811C, for the production of seamless tubing. The ASTAR-811C alloy has a nominal composition (weight percent) of W = 8, Hf = 0.75, Re = 1, and C = 0.025 with balance Ta. The alloy was developed in the 1960s at Westinghouse Electric Corporation. At the time of original development, plate and sheet were fabricated from small heats. Scale-up of ASTAR-811C to 36- and 138-kg ingots has been carried out in the past. However, no tubing was fabricated. The purpose of the present investigation was to produce scaled-up quantities of ASTAR-811C and to fabricate tubing. Melting scale-up was performed at Cabot Corporation and the Oak Ridge National Laboratory (ORNL), and the tube fabrication from scaled-up heats was carried out at ORNL. 2 refs., 3 figs., 1 tab.

6168 **(ECN—206) Effect of low neutron fluences on DIN 1.4948 steel creep properties.** Schaaf, B. van der. (Netherlands Energy Research Foundation, Petten). Apr 1988. 75p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704416/JAW.

Components near the core of a loop type liquid metal fast breeder reactor, LMFBR, such as shield vessel, reactor vessel and instrumentation support are exposed to irradiation with thermal neutrons up to 10/sup 25/ n.m./sup -2/ at temperatures of 823 K. Three heats of DIN 1.4948 were irradiated in the HFR-Petten to helium contents in the range from 0.2 appb to 20 appm at 325 K and 823 K. Subsequent post-irradiation creep tests conducted at 823 K with stresses in the range from 150 MPa to 300 MPa indicated decreasing rupture times and increasing secondary creep rates and reductions in secondary and tertiary creep strains. The embrittlement results in decreasing creep strength with increasing helium content. Helium filled cavities on grain boundaries have not been observed. A failure mechanism based on helium promoted wedge crack nucleation and propagation is proposed. From the mechanism a relation between the helium content and the Monkman Grant product of secondary creep rate and rupture time has been derived. There is an acceptable fit between the relation and data points. The results are supported qualitatively by optical and scanning electron microscopy. With increasing helium content the Monkman Grant product decreases considerably. The observed reduction in creep strength and ductility related to helium content can be used for the development of design rules for permanent components near LMFBR's. The effect of irradiation temperature and test creep stress have a minor influence on the observed embrittlement. 62 refs.; 27 figs.; 16 tabs.

6169 **(EMR/MS—MTL-17(TR)) Evaluation of SMAW [shielded metal-arc welding] consumables for repair of weld-zone corrosion.** Bringham, R.J.; Mitrovic-Scepanovic, V. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Sciences Lab.). 1988. 16p. (MICROLOG—88-02664). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Canadian Coast Guard owns and maintains a large variety of ships which operate in Gulf and Arctic ice conditions. This fleet has been experiencing preferential corrosion of weld metal. Such corrosion over a period of time requires recurring repairs throughout the operational life of an icebreaking ship. A research project was initiated to identify the optimum welding consumables and welding parameters to repair corroded welds. Evaluation of the corrosion characteristics of the same welds was performed by tank testing. Five shielded metal-arc welding (SMAW) consumables were evaluated as candidates for repairing weld-zone corrosion in ships constructed of Grade A, Grade E and Grade EH steels. A spectrum of corrosion rates was observed but E55018-C3 and OK73.08 repair electrodes were found to be compatible with all baseplates including Grade EH containing 1.39% Mn. 3 refs., 5 figs., 4 tabs.

6170 **(EMR/MS—MTL88-15(TR)) Improvement of corrosion-wear behaviour of materials by novel surface treatment technology.** Hindam, H. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Sciences Lab.). 1988. 27p. (MICROLOG—88-02662). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Materials resistance to corrosion and/or mechanical wear is a prime requisite for many engineering applications. In particular, materials are being subjected to increasingly aggressive environments, particularly in the new technologies for burning and converting fossil fuels. Novel surface treatment techniques reviewed in this report offer a broad spectrum of opportunities to improve the corrosion-wear behaviour of surfaces without altering desirable bulk properties. Because of the shallow affected depth and the limited amount of foreign substance which can be introduced into the substrate, ion implantation will be limited to applications which are quite sensitive to composition such as abrasive wear and mechanical behaviour of scales. Capital and operating costs are somewhat prohibitive to a wide commercial exploitation. However, ion implantation is considered as a unique investigative tool for studying the effects of minor additions on surface-sensitive properties. Laser treatments and plasma spraying offer a wide flexibility in microstructural control and the deposition of a wide variety of materials, respectively. They may be regarded as complmentary techniques for the optimization of the compositions and microstructures of surfaces. The major shortcoming of both techniques is the lack of throwing power; however, this has been largely overcome in advanced systems by utilizing computer-assisted handling systems. 55 refs., 4 figs.

6171 **(EPM/CDT—8708) Study of the effect of titanium and sulfur on the toughness properties of weld metal deposits from low hydrogen electrodes.** St-Laurent, S.; Cutler, L.; L'Esperance, G. (Ecole Polytechdnique de Montreal, Quebec (Canada). Centre de Development Technologique). 1987. 250p. (MICROLOG—88-01685). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Ever-increasing concern for prevention of brittle fractures in welded structures, especially for Arctic environments, has led to the need for improved notch toughness of the weld metal at lower temperatures. Electrodes for shielded metal arc welding (SMAW) are presently available, but toughness can vary drastically with welding procedure and position. The main aim of this study is the consistent achievement of low temperature impact properties comparable to Charpy V-notch toughness of 27-50 J at -60/sup 0/C. More specifically, SMAW consumables (low hydrogn electrodes) are the object of this study since they are most likely to satisfy such requirements. In addition, the work centered on the as-deposited area of the weld metal, as it is usually the area exhibiting the lowest toughness values. A special welding procedure was developed to allow notch toughness samples to be taken from welds with the largest amount of as-deposited metal possible; this required a large number of experiments. It was intended to compare the results obtained ith this technique with those obtained with a standard multipass welding procedure. The final aspect of this work is the role played by alloying additions on the microstructural development, and hence on the weld metal toughness. The effect of three Ti levels, three S levels, and of two strong deoxidants (Ca and Al) were systematically investigated. The effects of alloying elements on the microstructural development are described, particularly the formation and role of inclusions on the nucleation of acicular ferrite which is responsible for high toughness values. 86 refs., 102 figs., 18 tabs.

6172 **(EUR—11347) Enhanced diffusion due to electrons, protons and quenching.** Schuele, W. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1987. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755652/JAW.

Results of investigations of radiation enhanced diffusion in copper -30% zinc alloys using 17.65 MeV protons are reported and compared with results obtained for 2 MeV electrons. The activation energy of diffusion decreases considerably from 0.35 eV to 0.26 eV for displacement rates increasing from 3x10/sup -12/ dpa.s/sup -1/ to 1.2x10/sup -8/ dpa.s/sup -1/, i.e. the migration activation energy of interstitials decreases for this dpa.s/sup -1/ range from 0.70 eV to 0.52 eV. Results of electron irradiations obtained for 0.050 and 0.10 mm thick specimens are compared. It is found that the diffusion rates increase considerably in the presence of dislocations and that the diffusion rates decrease for very low electron fluxes and high irradiation temperatures in the 0.050 mm thick specimens in comparison to the rates obtained in 0.10 mm thick specimens. A value of 0.95 eV was determined for the activation energy of the ordering rate after quenching from 250/sup 0/C in water. This was attributed to the migration activation energy of vacancies.

6173 **(FEI—1863) Study of kinetics of nickel low-temperature irradiation by nickel ions.** Golubov, S.I.; Konobeev, Yu.V.; Rudnev, S.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704947/JAW.

Kinetics of radiation damages under low-temperature irradiation (50 and 300 deg C) of thinned foils by nickel ions with 50 keV energy preliminarily irradiated by the same ions up to 20 dpa at 550 deg C temperature is studied experimentally and theoretically. An attempt is made to describe theoretically observed pore annealing assuming that vacancies are immobile during irradiation. Experimental potentialities of such irradiation for studying mechanisms of interaction of intrinsic interstitial atoms with different effluents in metals are discussed. 5 refs.; 1 fig.

6174 **(INIS-mf—11860) Hydrogen in metals. Results of a point-of-main-effort programme - supported from 1977 to 1985.** (Deutsche Forschungsgemeinschaft, Bonn (Germany, F.R.)). 1986. 517p. (In German). NTIS (US Sales Only), PC A22/MF A01. Order Number DE88756106/JAW.

The report briefly describes the results of the single projects promoted by the German Council of Research (DFG). The subjects deal with diffusion, effusion, permeation and solubility of hydrogen in metals. They are interesting for many disciplines: metallurgy, physical metallurgy, metal physics, materials testing, welding engineering, chemistry, nuclear physics and solid-state physics. The research projects deal with the following interrelated subjects: solubility of H/sub 2/ in steel and effects on embrittlement, influence of H/sub 2/ on the fatigue strength of steel as well as the effect of H/sub 2/ on welded joints. The studies in solid-state research can be divided into methodological and physico-chemical studies. The methodological studies mainly comprise investigations on the analytical determination of H/sub 2/ by means of nuclear-physical reactions (e.g. the /sup 15/N method) and the application of the Moessbauer spectroscopy. Physico-chemical problems are mainly dealt with in studies on interfacial reactions in connection with the absorption of hydrogen and on the diffusion of H/sub 2/ in different alloy systems. The properties of materials used for hydrogen storage were the subject of several research projects. 20 contributions were separately recorded for the data bank 'Energy'.

6175 (INIS-SU—41, pp 9-13) **Determination of location of chromium atoms displaced from lattice sites due to radiation damage.** Artsimovich, M.V.; Mogil'nik, I.F.; Soroka, V.I.; Tokarevskij, V.V.; Kirilyuk, A.P.; Molodkin, V.B.; Nekrasov, A.A.; Chuistov, K.V.; Shalaev, A.M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij; AN Ukrainskoj SSR, Kiev. Inst. Metallofiziki). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Alpha-particle (2.2 MeV) channelling method was used to investigate radiation damaging of Cr-1.5 at.%, V-0.1 at.% Ta monocrystals, irradiated in a nonoriented state by α-particles of the same energy up to {similar←to}0/sup 18/ cm/sup -2/ dose (current density is {similar←to}x10/sup 13/ cm/sup -2/xc/sup -1/, T≅00 K).Crystal structure disordering increase with the dose growth is practically linear and is comparatively low. To analyse experimental data results both classical and quantum-mechanical channelling descriptions are used.It is ascertained, that <110> dumbbell appears to be the main chromium interstitial atom configuration. The results obtained may be used when evaluating the possibilities of applying α-particle channelling method for chromium monocrystal investigation. 10 refs.; 2 figs.; 1 tab.

6176 **(JAERI-M—88-150) Development of niobium alloy/stainless steel joint by friction welding, (1).** Kikuchi, Taiji; Kawamura, Hiroshi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 36p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755524/JAW.

The niobium alloy and stainless steel have been jointed by the nicrobrazing method generally. However the strength of the jointed part is weaker than that of the mother material. Therefore we developed the niobium alloy(Nb-1 % Zr)/stainless steel(SUS 304) transition joint by the friction welding method. As the tests for the development. We conducted the mechanical tests (tensile test at room temperature, 300 deg C, 500 deg C and 700 deg C, torsion fatigue test and burst test), metallographical observation and electron prove X-ray microanalysis observation. Those tests proved jointed part by the friction welding had enough properties for general uses.

6177 **(MLM—3554) Cost estimate for muddy water palladium production facility at Mound.** McAdams, R.K. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 30 Nov 1988. Contract AC04-88DP43495. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004433/JAW.

An economic feasibility study was performed on the "Muddy Water" low-chlorine content palladium powder production process developed by Mound. The total capital investment and total operating costs (dollars per gram) were determined for production batch sizes of 1--10 kg in 1-kg increments. The report includes a brief description of the Muddy Water process, the process flow diagram, and material balances for the various production batch sizes. Two types of facilities were evaluated--one for production of new, "virgin" palladium powder, and one for recycling existing material. The total capital investment for virgin facilities ranged from $600,000 --$1.3 million for production batch sizes of 1--10 kg, respectively. The range for recycle facilities was $1--$2.3 million. The total operating cost for 100% acceptable powder production in the virgin facilities ranged from $23 per gram for a 1-kg production batch size to $8 per gram for a 10-kg batch size. Similarly for recycle facilities, the total operating cost ranged from $34 per gram to $5 per gram. The total operating cost versus product acceptability (ranging from 50%--100% acceptability) was also evaluated for both virgin and recycle facilities. Because production sizes studied vary widely and because scale-up factors are unknown for batch sizes greater than 1 kg, all costs are "order-of-magnitude" estimates. All costs reported are in 1987 dollars.

6178 **(SERI/CP—210-3425) Conference on the science and technology of thin film superconductors: Book of abstracts.** (Solar Energy Research Inst., Golden, CO (USA)). 1988. Contract AC02-83CH10093. 191p. (CONF-881127—Absts.). NTIS, PC A06/MF A01 - OSTI. Order Number DE89000808/JAW.

From Conference on the science and technology of thin film superconductors; Colorado Springs, CO, USA (14 Nov 1988).

This report contains abstracts of papers presented at the conference on the Science and Technology of Thin Film Superconductors. (LSP)

6179 **(UCRL—99542) Concentration and temperature dependent effective cluster interactions in substituting disordered alloys.** Gonis, A.; Turchi, P.E.A.; Zhang, X.G.; Stocks, G.M.; Nicholson, D.M.; Butler, W.H. (Lawrence Livermore National Lab., CA (USA); Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy; Oak Ridge National Lab., TN (USA)). Sep 1988. Contract W-7405-ENG-48;FG02-84ER45097;AC05-84OR21400. 12p. (CONF-880901—12). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001295/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

We discuss methods which allow the determination of unique concentration dependent effective cluster interactions (ECI's) in substitutional alloys. These methods are based on the coherent potential approximation (CPA) and on the representation of the configuration dependent part of the disorder energy in terms of ECI's. Two schemes proposed for calculating ECI's within the CPA framework, the generalized perturbation method (GPM) and the embedded cluster method (ECM) are compared with one another and with the method proposed by Connolly and Williams, both formally and by means of calculations. It is found that the GPM and the ECM are conceptually and numerically quite similar, the ECM corresponding to a complete summation of certain terms in the GPM expansion. Both these methods lead to unique values of ECI's for a large class of substitutional alloys, particularly strong-scattering alloys such as those involving transition metals. The Connolly-Williams approach, on the other hand, yields ECI's depending on the size of the cluster used in the fitting procedure, and thus to nonunique predictions of phase stability. The use of the GPM/ECM in calculating most stable ordered structures at T = 0K is illustrated in terms of Pd V and Pd Rh alloys, and the possible use of these methods in constructing alloy phase diagrams is briefly discussed. 23 refs., 9 figs., 1 tab.

6180 **Some characteristics of Al/sub 12/Mo in aluminum annealed after implantation with molybdenum.** Stephenson, L.D.; Bentley, J.; Benson, R.B. Jr.; Hubler, G.K.; Parrish, P.A. (U.S. Army Construction Engineering Research Lab., 2902 Newmark Drive, Champaign, IL (US)). pp 461-466 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The characteristics of Al/sub 12/Mo formed in solution annealed after implantation with selected maximum molybdenum concentrations were examined by analytical electron microscopy techniques. The Al/sub 12/Mo was isolated as the only precipitate in the microstructure for maximum as-implanted molybdenum concentrations up to 11 atomic percent. The morphology of the Al/sub 12/Mo can be selected by choosing the maximum as-implanted molybdenum level over the same concentration range. A predominantly lamellar Al/sub 12/Mo precipitate structure formed when aluminum was annealed at 550{sup 0}C after implantation with maximum molybdenum concentrations in the range of 3.3 - 4.4 at.%. The orientation of the body centered cubic (bcc) Al/sub 12/Mo precipitate with respect to the face centered cubic (fcc) matrix can be expressed as (1-bar23)/sub rho/ parallel (002)/sub m/ and [301]/sub rho/ parallel [310]/sub m/. An explanation for the experimentally observed orientation relationship was developed based on the characteristic relationships between the bcc Al/sub 12/Mo precipitate and the fcc matrix. A continuous film of Al/sub 12/Mo formed in the surface modified region when aluminum was annealed after implantation with maximum molybdenum concentrations in the approximate range of 8 - 11 at.%. The microstructure of the Al/sub 12/Mo film was found to depend on the annealing temperature. A granular film formed after annealing at 550{sup 0}C whereas a mottled film formed after annealing at 400{sup 0}C. Sequential annealing experiments revealed that the mottled film transforms to a granular film which indicates the mottled film is metastable.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 6170, 6178, 6214, 6247, 7034, 7045, 7047, 7055, 7057

6181 **(CEA-CONF—9411) Nonstoechiometry and irradiation effects in cermets. Application for some actinide compounds.** Novion, C.H. de. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Dept. de Technologie; Ecole Polytechnique, 91 - Palaiseau (FR)). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). 1988. 2p. (In French). (CONF-880426—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755603/JAW.

From Annual meeting of the Atomic Energy Society of Japan; Tokyo, Japan (4 Apr 1988).

The fundamental knowledge and the understanding of ponctual defects behaviour in activide cermets such as uranium monocarbide and mononitride are still in their beginning. In this conference we present a fundamental research work review made in our laboratory on cristalline structure carbides and nitrides type NaCl.

6182 **(CEA-CONF—9489) Surface properties of dielectrics.** Le Gressus, C.; Maire, P.; Duraud, J.P.; Lecayon, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Mar 1988. 33p. (In French). (CONF-8803169—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755455/JAW.

From Training meeting on spectroscopic methods for interfaces and surfaces analysis; Thiasis, France (21 Mar 1988).

Importance of defects on dielectric behaviour (breakdown), mechanical behaviour (fracture, adhesion) and thermochemical behaviour of insulating materials is recalled. Then effect of a mechanical stress on breakdown voltage is studied. An experimental verification shows that fracture of Y/sub 2/O/sub 3/ is propagated in grain boundaries enriched in oxygen vacancies for a non stoichiometric sample by local variation of dielectric constant.

6183 **(EMR/MS—MSL87-155(TR)) Zirconia-toughened mullite ceramics (ZTM).** Aota, J.; Kuriakose, A.K.; Wheat, T.A.; Quon, D.H.H. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Sciences Lab.). 1988. 26p. (MICROLOG—88-02658). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper describes research on mullite ceramics fabricated through a new experimental process. Significant improvements in fracture toughness and strength of the ZTM have been achieved which is attributed to the carefully controlled processing techniques. Several advanced ceramic materials have been found suitable for engine components. Among these ceramics, zirconia possesses excellent fracture toughness, but the temperature dependency of this toughness limits its uses to below 1,000/sup 0/C. Mullite is also considered a candidate for structural ceramic applications, and reinforcement of mullite with a second phase such as ZrO/sub 2/ could improve its mechanical properties significantly. This paper describes research on zirconia toughened mullite (ZTM) ceramics fabricated through a new experimental process. Significant improvements in fracture toughness and strength of the ZTM have been achieved which is attributed to the carefully controlled processing techniques. It was shown that the incorporation of MgO stabilized zirconia in a sintered mullite composite results in an increase in both the flexural strength and fracture toughness of the matrix. In the case of 15 vol% monoclinic-ZrO/sub 2/ and MgO stabilizer added to mullite and sintered to full density at 1640/sup 0/C, the flexural strength increases to over 300 megapascals for the zirconia-mullite composite compared with the original value of 150 megapascals for ZrO/sub 2/-free mullite. Similarly the fracture toughness increases with the addition of zirconia. These mechanical properties of the materials developed so far are superior to those reported in the literature. As no major change in overall processing and capital equipment is required to achieve these improvements, and as raw material costs are increased less than 25%, it is anticipated that this material will have applications in many wear-resistant uses. 18 refs., 4 figs., 6 tabs.

6184 **(EMR/MS—MSL88-9(IR)) Hydrothermally synthesized zirconia powder. A preliminary study.** Wong, S.S.B.; Quon, D.H.H.; Torrie, G.; Wheat, T.A. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Sciences Lab.). 1988. 15p. (MICROLOG—88-02660). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Structural ceramics are currently the focus of research due to their potential applications in heat engines, cutting tools and other wear-resistant components. Since zirconia is one of the most promising structural ceramics, a study was carried out to examine the feasibility of producing superfine ZrO/sub 2/ powders using the hydrothermal technique. This technique has emerged as an attractive alternative to the conventional and sol-gel processes because superfine powder can be produced at relatively low temperature and pressure. In this study, a laboratory autoclave was used to synthesize zirconia powder by reacting zirconium oxychloride with water or aqueous urea under elevated pressure-temperature (hydrothermal) conditions. Fine monoclinic zirconia powders are obtained at a temperature of 200/sup 0/C and a pressure of about 1.5 megapascals. X-ray diffraction and scanning electron microscopy were used to characterize the crystalline phase and the particle size measured by sedigraph. The results indicate that aqueous urea produces ultra fine, well crystallized powder. 8 refs., 4 figs., 1 tab.

6185 **(IAE—4553/11) Diffusion track model of radiation additional sintering of uranium dioxide under reactor irradiation.** Lemekhov, S.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704451/JAW.

In the initial period of in-pile irradiation of uranium dioxide a significant change in the volume of initial inter- and intragrain pores produced at the final stage of pellet annealing in gaseous medium takes place. The model presented permits to calculate the dynamics of in-pile densification of uranium dioxide with determining influence of the basic initial, structural and radiation factors such as distribution of pores and their size; distribution of density of point and extended defects under irradiation; temperature, rating and burnup. The presented densification model is based on a quantitative realization of the mechanisms of gaseous fission product diffusion and uranium ion self-diffusion, which may be supposed on the zone of the fission product track at the main stages of its formation and annealing. 33 refs.; 3 figs.; 2 tabs.

6186 **(IAE—4574/11) Diffusion-track model for gas release and swelling of uranium dioxide under irradiation.** Lemekhov, S.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 25p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704453/JAW.

A model is presented which permits the quantitative analysis of the main irradiation factors such as temperature, rating and burnup etc on the kinetics of the processes of fission gas release and gas swelling of uranium dioxide under in-pile irradiation conditions to be performed. 20 refs.; 6 figs.; 2 tabs.

6187 (INIS-SU—43, pp 59-62) **High resolution electron microscopy of high temperature superconducting ceramics YBa/sub 2/Cu/sub 3/O/sub 7/.** Vasil'ev, A.L.; Kiselev, N.A.; Romanchikova, G.V.; Golovashkin, A.I.; Ivanenko, O.M.; Mitsen, K.V.; Rodin, V.V. (AN SSSR, Moscow. Inst. Kristallografii). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

Using single-phase specimens of superconducting ceramics YBa/sub 2/Cu/sub 3/O/sub 7/ with T/sub s/=93 K and nearly ideal diamagnetism at T=80 K the crystal lattice structure is studied by high resolution electron microscopy. Two image types of the structure - stratified (with the period of 1.2 nm) and lattice (with the period of 0.38 nm) are discovered. 2 refs.; 8 figs.

6188 **(ORNL/TM—10791) Assessment of the state of the art in machining and surface preparation of ceramics.** Stinton, D.P. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 39p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003370/JAW.

Machining and surface preparation of advanced ceramic materials was assessed. Abrasive processes, including the commercially used process of traditional diamond grinding, are reviewed. Mechanisms of material removal are described to familiarize the reader with the surface damage created during machining. The more developmental nonabrasive techniques are then described. Finally, recommendations are made for additional areas of research that have significant potential to reduce the cost and increase the reliability of ceramics. 90 refs., 14 figs.

6189 **(ORNL/TM—10827) Review of nonstoichiometry in YBa{sub 2}Cu{sub 3}O{sub 7-x}.** Lindemer, T.B.; Sutton, A.L. Jr. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003721/JAW.

The literature data for the dependence of x in YBa{sub 2}Cu{sub 3}O{sub 7-x} on temperature and oxygen pressure was retrieved to provide a numerical data base. These data were reviewed, and each data set was fitted to give the general interrelationship of the experimental variables. 19 refs., 7 figs., 2 tabs.

6190 **(SAND—88-2682C) Thermoelectric properties of boron carbides.** Aselage, T.; Emin, D.; Wood, C. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 5p. (CONF-890103—1). NTIS, PC A02/MF A01 - OSTI. Order Number TI89001238/JAW.

From 6. symposium on space nuclear power systems; Albuquerque, NM, USA (9 Jan 1989).

Boron carbides are ceramic materials with unusual properties and applications. These refractory materials (T/sub m/ > 2600K)

exist as a single phase over a wide range of stoichiometries, from 20 a/o carbon to less than 10 a/o carbon (Bouchacourt and Thevenot 1981). The relatively low density (~2.5 g/cm^3) and exceptional hardness lead to applications in the area of ceramic armor. In addition, ^{10}B has a large capture cross section for thermal neutrons. This fact, along with the robust nature of the structure in a high radiation environment, leads to the use of boron carbides as nuclear reactor control materials. Because of a combination of unusual high temperature electronic and thermal properties, boron carbides also make efficient very high temperature (p-type) thermoelectrics. In this paper, we shall review the electrical and thermal properties of boron carbides and describe recent progress in understanding these properties. 13 refs., 4 figs.

6191 **Large anisotropy in the upper critical field of sputtered thin films of superconducting Tl-Ba-Ca-Cu-O.** Kang, J.H.; Gray, K.E.; Kampwirth, R.T.; Day, D.W. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Applied Physics Letters;* **53**: No. 25, 2560-2562(19 Dec 1988).

The upper critical field B/sub c/$_2$ provides the most direct measure of the intrinsic anisotropy of a superconductor. For highly oriented, sputtered thin films of the high-temperature superconductor $Tl_2Ba_2CaCu_2O$/sub x/, we find a B/sub c/$_2$ anisotropy of at least 70, which exceeds similar measurements on thin films and single crystals of the high-temperature superconductors Bi-Sr-Ca-Cu-O and YBa_2Cu_3O/sub y/. We discuss why the midpoints of the resistive transitions, used in these measurements, may be appropriate for defining the intrinsic B/sub c/$_2$.

3606 Other Materials

REFER ALSO TO CITATION(S) 5762, 5779, 5965, 6300, 7031, 7044

6192 **(AC—1987) Determination of the resistance of concrete to abrasion and impact by ice under offshore and Arctic conditions.** (Arctec Canada Ltd., Kanata, Ontario). [1987]. 77p. (MICROLOG—88-01191). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report concerns the development of a laboratory test to evaluate the effects on concrete of ice impact abrasion, as would be found under Canadian Arctic and offshore conditions. The apparatus used in the tests permitted testing of the combined effects of ice abrasion and ice impacts against rotating concrete cylinders or large dimensions used as test specimens. The concrete properties, test procedures, and test apparatus are described. Initial results were obtained during 166 hours of testing on one set of concrete specimens and during 80 hours on a second set. Based on these tests, the conclusions presented include the following. The unique test apparatus developed in this investigation appears to provide a useful means of studying abrasion and/or impact by ice against concrete; however, in its present configuration, it may subject the concrete specimens to unequal abrasion forces, and modifications are required to correct this. Dry abrasion conditions promote the formation of a protective ice layer at an early stage of interaction; this layer is stable and is not removed by intermittent ice impact. Wet abrasion conditions indicate that the ice abrades the concrete surface at varying rates depending on the local contact pressure, surface finish, and concrete strength. The abrasion rate is high at the beginning of the interaction and drops to what appears to be a steady state rate. The surface finish of the concrete affects the initial wear rate. Ice impact at speeds up to 2 m/s has no immediate effect, but later preferential wear was observed with the progress of abrasion. 1 ref., 26 figs., 17 tabs.

6193 **(DOE/ER/13663—T2) Structure and reactivity of chemisorbed species and reaction intermediates: Progress report, 1 December 1987--30 November 1988.** Madey, T.E. (National Bureau of Standards, Washington, DC (USA)). 1 Aug 1988. Contract AI01-87ER13663. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003342/JAW.

The areas of work supported under this contract by DOE during the period 12/1/87-11/30/88 have a common theme: the structure and reactivity of chemisorbed species and reaction intermediates of importance to catalysis. A variety of tools have been used to study the structure and chemistry of surface species, and to develop models and concepts of broad utility in chemisorption and catalysis. Results of the research conducted or completed in the last year are described in this report, along with plans for next year. Results, summarized below, are presented in detail: I. Surface Reactions and Catalysis Over Well-Characterized Surfaces. This includes: Adsorption and surface reactions over model thin-film catalysts, e.g., monolayer films of Pt on tungsten; Inelastic Incoherent Neutron Scattering (IINS) as an in situ probe of surface chemistry over high area metal powders. II. Structure and Reactivity of Chemisorbed Species. The aims of this effort include determination of (a) the structure and reactivity of small molecules on single-crystal metal surfaces and the influence of surface "additives" (promoters and poisons) on structure, and (b) the structure and surface chemistry of adsorbed halogen-containing species. 2 figs.

6194 **(DOE/ER/13790—1) Characterization of metal-support bonds in supported metal catalysts: Progress report.** Gates, B.C. (Delaware Univ., Newark (USA). Center for Catalytic Science and Technology). 12 Oct 1988. Contract FG02-87ER13790. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003543/JAW.

The research is an investigation of the synthesis, structure, and bonding of a family of oxide-supported metal complexes: W, Re, Os, Ir, and Pt on {gamma}-Al{sub 2}O{sub 3}, MgO, and SiO{sub 2}. The surface species are being prepared from mononuclear organometallic precursors and characterized by TPD, IR, NMR, EXAFS, and other spectroscopies. The emphasis is on the structure of the metal-support interface. The surface-bound complexes are to be reduced gently in H{sub 2} and the structural changes followed as ultradispersed supported metals are formed. The first results have been obtained for the precursors W(CO){sub 6}, HRe(CO){sub 5}, and H{sub 2}Os(CO){sub 4} combined with {gamma}-Al{sub 2}O{sub 3} and with MgO. 1 tab.

6195 **(DOE/ER/45237—3) Kinetics of phase separation in polymer solutions and blends: Performance report, 4/1/86--3/31/89.** (State Univ. of New York, Stony Brook (USA). Dept. of Chemistry). [1988]. Contract FG02-86ER45237. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003212/JAW.

During the interim period (3/1/87--7/31/88), close to one million data points of SAXS measurements on fractal geometry in branched epoxy polymers, sulfonated polystyrene ionomers and a low-density polyethylene/high-density polyethylene (LDPE/HDPE) blend were analyzed. We also developed a precision capillary viscometer which has a time resolution of +-0.001 second, about a factor of 10 better than commercial capillary viscometers. Together with light scattering, observation of a single polymer coil collapse, based on both static (radius of gyration) and dynamic (hydrodynamic radius) properties, was achieved. Efforts have been made to improve and construct instruments which are needed for the DOE project. 6 figs., 1 tab.

6196 **(DPST—88-693) Deuterium permeation through EPDM rubber compounds.** Zapp, P.E. (Savannah River Lab., Aiken, SC (USA)). 1988. Contract AC09-76SR00001. 14p. (CONF-8805179—3). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002457/JAW.

From DAMSUL committee meeting; Las Vegas, NV, USA (11 May 1988).

The permeation of deuterium through a specially formulated compound of ethylene propylene diene rubber was measured in the temperature range of 26{degree}C to 120{degree}C. The results were similar to permeation through two commercial compounds of this elastomer. Permeation was reduced after gamma irradiation (in the presence of hydrogen gas to simulate a tritium exposure). However the reduction was smaller than that experienced by the two commercial compounds. Radiation damage is apparently less severe in the special compound. It is possible that mechanical properties such as compression set may be influenced less by ionizing radiation in this compound as compared with the commercial compounds. 4 figs., 1 tab.

6197 **(SAND—88-0614) Identification of antistatic packaging material as a source of circuit board contamination.** Rodacy, P.J.; Burns, F.B.; Ward, K.J. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 19p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89001007/JAW.

Circuit boards to be used in satellites were shipped to Sandia in Richmond RCAS 4200 ESD shielding bags. Upon inspection under low magnification, a white fuzzy deposit was observed on many of the solder joints. Preliminary examination using Fourier transform infrared (FT-IR) microspectroscopy identified the material as a metal salt of a long chain aliphatic carboxylic acid. The material was definitively identified as a mixture of lead di(n-octanoate) and tin di(n-octanoate) using mass spectrometry. These compounds were formed by the reaction of octanoic acid with the lead/tin solder. We have demonstrated that the solder is mechanically weakened by the formation of these compounds. Investigation has shown that the Richmond RCAS 4200 ESD shielding bags contain octanoic acid in sufficient quantities to form visually detectable quantities of lead di(n-octanoate) and tin di(n-octanoate) in less than 90 days at room temperature. Ameri-Stat Static Shield and Dow Chemical CHIPLOC ES antistatic bags do not contain carboxylic acids, and solder samples stored in these bags for several months do not exhibit evidence of lead di(n-octanoate) or tin di(n-octanoate) formation. Users of static shielding bags should be aware that the use of static shielding bags can be harmful to solder joints. Steps should be taken to ensure that all antistatic packaging in use is free from carboxylic acid contamination. 3 refs., 6 figs., 1 tab.

6198 **(SAND—88-1711C) Metal-organic chemical vapor deposition of InSb on GaAs and InSb in an inverted stagnation point flow geometry.** Hebner, G.A.; Biefeld, R.M.; Killeen, K.P. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 14p. (CONF-881155—13). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003900/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Several properties of InSb such as high mobility and narrow bandgap make it an attractive candidate for many unique devices. We have examined the metal-organic chemical vapor deposition (MOCVD) of InSb on GaAs and InSb substrates under a variety of conditions using trimethylindium and trimethylantimony sources. The absolute metal-organic partial pressures above the susceptor were monitored using in-situ uv absorption spectroscopy. X-ray studies of the homoepitaxial growth of InSb on InSb substrates (100) indicates good crystalline epitaxial growth while the x-ray peak for the InSb grown on GaAs (100) is broadened due to defects. Room-temperature Hall mobility measurements performed on the heteroepitaxial InSb layer on GaAs substrates indicates that the mobility of the InSb increases with increasing layer thickness. Mobilities range from 12,000 cm{sup 2}/V sec for 0.8 microns to 38,000 cm{sup 2}/V sec for 7.4 micron layers. The carrier concentrations are relatively constant (2 to 4 x 10{sup 16} cm{sup -3}) for the n type InSb deposited layers. 4 refs., 9 figs.

6199 **(SAND—88-2925C) Electron storage InAs/AlAsSb metal-insulator-semiconductor quantum well heterostructures.** Lott, J.A.; Dawson, L.R.; Weaver, H.T.; Zipperian, T.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 5p. (CONF-8809152—5). NTIS, PC A02/MF A01 - OSTI. Order Number DE89002021/JAW.

From International symposium on gallium-arsenide and related compounds; Atlanta, GA, USA (11 Sep 1988).

We report the first electrical characterization of an InAs/AlAsSb metal-insulator-semiconductor quantum well heterostructure fabricated on MBE grown material. Hysteresis was observed in the C-V data from which decay constants, associated with electron storage, of about 50 seconds at 77K were determined. Approximately 1-5% of the charge decayed much slower and exponentially in time and exhibited a thermal activation energy of neat 0.9 eV. 9 refs., 4 figs.

6200 **(SKB-TR—88-15) Hydrothermal effects on montmorillonite. A preliminary study.** Pusch, R.; Karnland, O. (Clay Technology AB, Lund (Sweden)). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Jun 1988. 70p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756092/JAW.

Hydrothermal effects on montmorillonite clay are usually taken to have the form of conversion of this clay mineral to other species, such as illite, disregarding microstructural alteration and cementation caused by precipitation of silica and other compounds. The report is focussed on identification of the primary processes that are involved in such alteration, the release of silica and the microstructural changes associated with heating being of major interest. In the first test phase, Na montmorillonite in distilled water was investigated by XRD, rheology tests and electron microscopy after heating to 60-225/sup 0/C for 0.01 to 1 year. The preliminary conclusions are that heating produces contraction of the particle network to form dense 'branches', the effect being most obvious at the highest temperature but of significance even at 60-100/sup 0/C. Release of substantial amounts of silica gas been documented for temperatures exceeding 150/sup 0/ and precipitation of silica was observed on cooling after the hydrothermal testing under the closed conditions that prevailed throughout the tests. The precipitates, which appeared to be amorphous and probably consisted of hydrous silica gels, were concluded to have increased the mechanical strength and caused some brittleness, particularly of the dense clays. The nature of the silica release, which is assumed to be associated with beitellitization, may be closely related to an unstable state of a certain fraction of tetrahedral silica at heat-inducted transfer between two different crystal modes of montmorillonite.

6201 **Non-Newtonian strain relaxation in highly strained SiGe heterostructures.** Dodson, B.W.; Tsao, J.Y. (Sandia National Laboratories, Albuquerque, New Mexico 87185-5800). *Applied Physics Letters;* **53**: No. 25, 2498-2500(19 Dec 1988).

Semiconductor strained-layer structures routinely incorporate layer stresses in the GPa regime. At these stresses, models for strain relaxation cannot be based on material parameters determined at small stresses. A new analysis of experimental data on strain relaxation in metastable SiGe/Ge(001) strained-layer structures allows the effects of high stresses on relaxation kinetics to be determined. The activation energy for plastic flow is found to decrease roughly linearly with increasing stress, in a manner analogous to non-Newtonian viscous flow in fluids. As a result, macroscopic relaxation occurs more easily and becomes dramatically more abrupt as the growth temperature is reduced than would be extrapolated from the small-stress behavior. Implications for design and fabrication of metastable strained-layer devices are discussed.

6202 **Structural and dynamical correlations in Ag_2Se: A molecular dynamics study of superionic and molten phases.** Rino, J.P.; Hornos, Y.M.M.; Antonio, G.A.; Ebbsjoe, I.; Kalia, R.K.; Vashishta, P. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **89**: No. 12, 7542-7555(15 Dec 1988).

We study the structural properties, single-particle dynamics, and the charge transport in superionic and molten Ag_2Se using the method of molecular dynamics. The calculations are based on a model of interionic potentials in which the ions interact through Coulomb interaction, steric repulsion, and charge--dipole interaction due to the large electronic polarizability of the selenium ions. In the superionic phase the Ag ions diffuse through a stable bcc lattice of Se atoms. Structural and dynamical correlations are studied at five temperatures in the superionic phase and three temperatures in the molten phase. Among the structural correlations the results are presented for partial pair distribution functions, coordination numbers, partial structure factors, bond angle distributions, and the wave vector and temperature dependence of the Bragg intensities. Detailed comparison with the neutron and x-ray single crystal diffraction results are made whenever possible. Diffuse neutron and x-ray scattering is calculated and investigated in detail in the vicinity of $q_0 = (1.6,1,0)$. It is shown that the anisotropic disks of intensity arise entirely due to the collective motions of silver ions and that these correlations manifest in the q space at a point where the Se–Ag partial structure factor is nearly zero. The calculated tempera-

ture dependence of the self-diffusion constant of silver is in good agreement with the tracer diffusion measurements. The spectra of velocity autocorrelation functions and the frequency dependent ionic conductivity are calculated. The Haven's ratio, derived both from the calculated self-diffusion and zero frequency limit of the ionic conductivity, is in good agreement with the experimental results of Okazaki.

6203 **Asymmetric tilt boundaries and generalized heteroepitaxy.** Dodson, B.W.; Myers, D.R.; Datye, A.K.; Kaushik, V.S.; Kendall, D.L.; Martinez-Tovar, B. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* **61**: No. 23, 2681-2684(5 Dec 1988).

In conventional heteroepitaxy, lattice mismatch is accommodated through biaxial strain and interfacial misfit dislocations. In studies of the heterophase boundaries appearing in semicoherent α-Si_3N_4 precipitates grown in situ in a silicon matrix, we have found that part of the lattice mismatch can be accommodated by formation of low-energy asymmetric tilt boundaries, which accommodate the lattice mismatch without producing a long-range stress field. This result suggests that growth of misfit-dislocation--free lattice-mismatched tilted structures should be possible.

6204 **Viscoelasticity of near-critical gels.** Martin, J.E.; Adolf, D.; Wilcoxon, J.P. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* **61**: No. 22, 2620-2623(28 Nov 1988).

Viscoelastic measurements on gels near the gel point show power-law frequency and time dependences. Using a percolation model, we find that viscoelastic properties are described by the universal exponent {Delta}= d{nu}/(d{nu}+k) where k is the viscosity exponent, {nu} is the correlation-length exponent, and d is the dimension of space. This expression leads to a theory for the critical growth of the equilibrium shear modulus beyond the gel point, and the steady-state creep compliance beneath the gel point. Viscoelastic data are given for epoxy resins.

6205 **Preparation of ceramic matrix and alumina fiber composites for use as solid electrolytes.** Dudney, N.J. (to to Dept. of Energy). US Patent Application 6-044,176. 30 Apr 1987. 12p. Contract AC05-84OR21400. DE89000216 NTIS, PC A02/MF A01 - OSTI. Order Number DE89000216/JAW.

A process for making solid electrolytes using a fibrous stabilizing dispersed second phase for enhanced conductivity of the electrolyte after deformation and annealing. 1 tab.

6206 **Time-resolved spectroscopy of plasma resonances in highly excited silicon and germanium.** Malvezzi, A.M.; Huang, C.Y.; Kurz, H.; Bloembergen, N. (Div. of Applied Sciences, Harvard Univ., Cambridge, MA (US)). pp 201-212 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The dynamics of the electron-hole plasma in silicon and germanium samples irradiated by 20 ps, 532 nm laser pulses has been investigated in the near infrared by time-resolved picosecond optical spectroscopy. The experimental reflectivities and transmissions are compared with the predictions of the thermal model for degenerate carrier distributions through the Drude formalism. Above a certain fluence, a significant deviation between measured and calculated values indicates a strong increase of the recombination rate as soon as the plasma resonances become comparable with the band gaps. These new plasmon-aided recombination channels are particular pronounced in germanium.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 5769, 5770, 5771, 5775, 5844, 5869, 5870, 5871, 5872, 6080, 6180, 6227, 6230

6207 **(BNL—41908) Single-particle Raman spectroscopy.** Tang, I.N.; Fung, K.H. (Brookhaven National Lab., Upton, NY (USA)). Sep 1988. Contract AC02-76CH00016. 7p. (CONF-8806239—4). NTIS, PC A02/MF A01 - OSTI. Order Number DE89002911/JAW.

From CRDEC scientific conference on obscuration and aerosol research; Aberdeen, MD, USA (22 Jun 1988).

Raman spectra of suspended single aerosol particles were obtained for several environmentally important species, such as sulfates and nitrates. Quantitative measurements were also established for sulfate and nitrate mixtures in both crystalline and aqueous states under controlled laboratory conditions. The present work demonstrates the feasibility of a nondestructive and unique technique for aerosol composition analysis. 2 figs.

6208 **(CONF-871016—2) Use of high-gradient magnetic fields for the separation of macromolecules.** Scott, T.C.; Brumfield, T.L. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89001673/JAW.

From 5. symposium on separation science and technology for energy applications; Knoxville, TN, USA (25 Oct 1987).

High gradient magnetic field separation (HGMS) has been used to separate several types of > 1 μm sized ferro- or paramagnetic particles from bulk streams. The majority of the studies have been carried out using a single ferromagnetic wire or wire mesh to produce the field gradients necessary for particle capture. The purpose of this paper is to examine the possibility of using HGMS on < 1 μm entities for the purpose of macromolecular separations. Preliminary experimental results demonstrate that HGMS techniques can be used to capture 0.1 μm diam latex beads from a paramagnetic salt solution passing through a columnar bed of ferromagnetic spheres. 10 refs., 3 figs.

6209 **(EMR/OERD—ERL87-74(TR)) Investigation of new column packings for molecular weight determination of heavy fractions by size exclusion chromatography.** Coulombe, S.; Desjardins, S. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Office of Energy Research and Development). 1987. 12p. (MICROLOG—88-01550). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

New packing materials for size exclusion chromatography columns were investigated. Polytetrafluoroethylene (Teflon) and carborundum (SiC) were selected because of their inertness and potential to avoid secondary interactions, such as adsorption and hydrogen bonding, that would add to the size exclusion effect and make the molecular weight determination of complex samples like heavy oils and bitumen very dificult. The efficiency of columns packed with these materials was calculated and column packing procedures are discussed. PTFE did not perform successfully because of the nonrepoducibility of the packing quality. Combinations of PTFE/SiC were used instead to provide more reproducible packings in terms of back pressure. Pure SiC columns were also investigated. The latter gave the best results in terms of theoretical plates, but the plate counts were still far from commercial columns. However, mixed columns generally provided a better molecular weight working range. An artificial back pressure had to be set up for columns packed partially or totally with carborundum to improve the repeatability. Results were not encouraging enough to pursue this approach. 3 refs., 3 figs., 5 tabs.

6210 **(EPS—TS2) PCB field test kit evaluation.** DeBellefeuille, M. (Environment Canada, Ottawa, Ontario. Environmental Protection Service). 1985. 38p. (MICROLOG—88-01168). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Evaluations were conducted of three polychlorinated biphenyl (PCB) field test kits manufactured by McGraw-Edison company, Syprotec, and Dexsil Chemical. Kit performance was evaluated first in the first in the lab and then in the field. The lab evaluation involved only the McGraw-Edison and Syprotec kits which were tested to determine their effectiveness in identifying the presence and concentration of PCBs. For the field evaluation, 86 oil samples were collected from out-of-service transformers awaiting disposal. Seventy-eight of the samples were tested with the field test kits. Of these, 40 were selected and submitted for analysis by gas chromatography (GC); the results of the analyses were used as a reference with which to compare the results obtained from the field test kits. Results of the study indicate that the overall performance of the kits is fairly consistent, although some variation was observed between results obtained using the gas chromatography. The confirmation test using GC were in agreement with Dexsil kit results for 94% of the samples, the Syprotec kit for 90% and the McGraw-Edison kit for 80%. This report identifies the advantages and disadvantages of each kit, lists operational problems, and recommends the use of PCB field test kits as an alternative to gas chromatography in certain cases. 3 figs., 4 tabs.

6211 **(INIS-BR—1276) Geology, petrology and geochronology of meridional and oriental regions of the Morungaba complex, SP.** Vlach, S.R.F. (Sao Paulo Univ., SP (Brazil). Inst. de Geociencias). 1985. 262p. (In Portuguese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88704519/JAW.

This work studies the Morungaba Intensive Complex, in Southwestern of Sao Paulo State. Formed principally by granitoid rocks with biotite. 31 granitoid facies with structural was recognized. Petrographic own characteristics. The rocks from Morungaba Complex was joint in three magmatics groups, denominated: Roby Gray and Porphyritic. Petrographic and mineralogical composition studies of this three groups were done. Geochranological studies by Rb/Sr and K/sr methods made possible to establish the ages and evolution of this rocks. This Complex formation and evolution are associated with the dioritic rocks presence. This work also concluded that the Morungaba Intrusive Complex represent the pos-orogenic wents from Brazilian Cycle. (C.D.G.).

6212 **(INIS-BR—1279) Utilization of /sup 40/An//sup 39/Ar method in policyclic rocks.** Kinoshita, H. (Sao Paulo Univ., SP (Brazil). Inst. de Geociencias). 1976. 69p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704522/JAW.

This work presents the results of twelve radiometric analyses by the /sup 40/Ar//sup 39/Ar method in biotites, anphiboles and plagio classes of rock of the Penhinha region. Nine determinations were made by the techniques of stepwise heating and three by metting of the sample. The different apparent ages of the minerals (515-1200 My), obtained by the technique of stepwise heating, seem to imply a a complex geologic history for the region, and confirms the existence of older emplacement nuclei, pre-Brazilians, affected by two orogenic cycles, at least, the first pre-Brazilian and the cycles, at least, the first pre-Brazilian and the second, Brazilian. On the other hand, the age determinations obtained by melting of plagioclasses ({similar←to}730 My), agreed with the conventional K-ar apparent ages, a fact with no geological meaning. The preliminary results show that the stepwise heating technique may become a valuable tool in the study of policyclic samples, because it permits to distinguish between disturbed and undisturbed rocks. The same cannot be said of the melting technique. In this latter case the results can be used only comparatively.

6213 (INIS-SU—61/A, pp 24-26) **Device for quantitative plutonium testing in mixed fuel by its neutron emission.** Gadzhiev, G.I.; Gorobets, A.K.; Golushko, V.V.; Dunaev, E.S.; Leshchenko, Yu.I. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

A device for quantitative plutonium testing in mixed fuel by its neutron emission is described. The method of "assigned dead time" for isolation of neutrons of spontaneous fission is used in the device. The main characteristics of the registrating equipment specifying the regime of measuring and affecting testing errors are presented. The results of spontaneous fission neutrons detection in the range up to 100 g of plutonium linearly depend on /sup 240/Pu. Sensitivity of testing makes up about 28 pul./s per 1 g of /sup 240/Pu. 2 figs.

6214 (INIS-SU—61/A, pp 9-11) **Automated measuring-control computer set for rapid determination of oxygen content in oxide nuclear fuel.** Baranov, V.G.; Godin, Yu.G.; Dimakov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

A method for determination of oxygen content in oxide nuclear fuel based on registration of thermo-emf signal arising at pulsed heating of specimens is developed. An installation controlled by means of a measuring-control computer set developed on the basis of the microcomputer is fabricated for realization of the method. The efficiency of the installation makes up 200 analyses/h, the error of determination of oxygen/uranium ratio (O/M) is not worse than +-0.001 units O/M. 4 refs.; 3 figs.

6215 **(INIS-SU—61/A) Radiation technique. Scientific-technical collection.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1987. 82p. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Individual papers in scope for the data base are processed separately. (DLC)

6216 **(JAERI-M—88-122) Elemental analysis of high-level radioactive liquid waste, (1). Analysis of simulated high-level liquid waste by ICP-AES.** Banba, Tsunetaka; Togashi, Yoshihiro. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 23p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755513/JAW.

In order to investigate the applicability of Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES) to elemental analysis of high-level radioactive liquid waste (HLLW), 20 elements in a simulated HLLW prepared for this study were analyzed by ICP-AES under the suitable operating conditions and the accuracy of analysis was discussed. Sixteen elements could be measured within 5 % of the relative standard deviation with the 1/10000 dilute solution. In cases of the analysis for actual HLLW having a high concentration of radioactivity (200 - 300 Ci/l), this dilution should be essential for the glove box treatment. Tellurium, Pr and P, because of the low concentration in HLLW (Te: 0.34 g/l, Pr: 0.74 g/l, P: 0.25 g/l) and the high detection limits (DL) of ICP-AES, required the 1/1000 dilute solution to obtain the values within 5 % of the relative standard deviation. For Na and the other alkali metal elements, the other analytical methods (for example, Atomic Absorption Spectroscopy) would be recommended.

6217 (MLM—3521, pp 8-12) **Applications of infrared microspectroscopy.** Carlson, R.S. Jul 1988. NTIS, PC A03/MF A01 - OSTI. Order Number DE88013959/JAW. Contract AC04-76DP00053.

In Technology Update - 88.

Instrumentation now available for infrared microspectroscopy makes it possible for the analyst to obtain infrared spectra of samples less than 1 nanogram in weight or as small as 50 μm^2 in area. Introduction of this technique at Mound is yielding insight into subvisual corrosion and contamination problems associated with energetic materials. Four recent cases, two relatively simple and two more complicated, are discussed. 13 figs.

6218 **(VW-FMT—8703-V/5) Fast liquid chromatography technique for PAC measurement in motor vehicle exhaust.** Hartung, A. (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.). Abt. Forschung und Entwicklung). 1987. 33p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755556/JAW.

The development of a fast method for PAC determination in motor vehicle exhaust necessitates matched optimisation of the various process steps. 14 PAC components can be analyzed in a single day by improving the extraction of the gas and particulate collection phase, by using miniature extraction columns for processing as well as special liquid chromatography separation columns, and by fluorescence detection analysis. The process parameters of the fast liquid chromatography process are compared with the process parameters of gas chromatography. The PAC concentrations measured by both methods were in agreement within the statistical margin (s/sub r/ = {le}35%). If the analysis is limited to the above 14 PAC, liquid chromatography is to be preferred because of its shorter analyzing time and materials savings.

6219 **A {sup 2}Pi--X {sup 2}{Sigma}{sup +} red and B {sup 2}{Sigma}{sup +}--X {sup 2}{Sigma}{sup +} violet systems of the CN radical: Accurate multireference configuration interaction calculations of the radiative transition probabilities.** Knowles, P.J.; Werner, H.; Hay, P.J.; Cartwright, D.C. (University Chemical Laboratory, Lensfield Road, Cambridge CB2 1EW, England). *Journal of Chemical Physics;* **89**: No. 12, 7334-7343(15 Dec 1988).

Potential energy, dipole moment, and electronic transition moment functions have been calculated for the X {sup 2}{Sigma}{sup +}, A{sup 2}Pi, and B {sup 2}{Sigma}{sup +} states of the CN radical using internally contracted CASSCF-CI electronic wave functions (configuration interaction with complete active space self-consistent-field reference functions) and large basis sets. All molecular orbitals which can be formed from the atomic 2s and 2p orbitals were included in the active space. The effect of adding {delta}orbitals to the active space was found to be small. The largest calculations included up to 987 reference configurations and were equivalent to uncontracted MR-CI calculations with 11.8 million configurations. These calculations are the most accurate that have been carried out to date in terms of the size of the basis set and the treatment of electron correlation effects. Using the theoretical transition moment functions and RKR potential energy functions, radiative lifetimes of the A {sup 2}Pi and B {sup 2}{Sigma}{sup +} states have been derived. The lifetimes of the A state vary between 11.2 {mu}s for v' = 0 and 5.3 {mu}s for v' = 10. The lifetime of the B, v' = 0 state is calculated to be 60.7 ns. These values are estimated to be accurate within 5% and are compared to previous experimental and theoretical data. The most recent experimentally measured lifetimes differ by 20% to 35% from the calculated values, while our results are in close agreement with other theoretical studies.

4002 Inorganic, Organic And Physical Chemistry

REFER ALSO TO CITATION(S) 5733, 5752, 5773, 5777, 5817, 5921, 6080, 6193, 6194, 6244, 6561, 7031

6220 **(CEA-IRDI-DESICP-RA—1987) Annual progress report of the physical chemistry department. Basic research 1987.** (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physico-Chimie). 1988. 245p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88755624/JAW.

Basic research for 1987 in physical chemistry of the French Atomic Energy Commission are reviewed. Topics include molecular chemistry, isotopic geochemistry, molecular photophysics, laser photochemistry, solid and surface physical chemistry. A list of publications and thesis is given.

6221 **(DOE/ER/13460—T1) [Energies of organic compounds]: Progress report.** (Yale Univ., New Haven, CT (USA)). 1988. Contract FG02-86ER13460. 21p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003395/JAW.

A procedure has been developed for determining the enthalpy of reduction of carbonyl groups, and has been successfully applied to aldehydes, ketones and esters. The enthalpies of hydrolysis of lactones have been determined and have been compared with that of esters having the same number of carbons. The enthalpies of hydration of alkenes which lead to tertiary alcohols have been measured giving exo/endo energy differences as well as the enthalpies of formation of the alcohols. An automated vaporization calorimeter has been constructed and has been applied to a number of compounds. The experimental studies have been supplemented by calculations of rotational barriers, and of substituent effects. 18 refs.

6222 **(DOE/ER/13501—4) Chemical activation of molecules by metals: Experimental studies of electron distributions and bonding: Progress report for period March 1, 1986--September 30, 1988.** Lichtenberger, D.L. (Arizona Univ., Tucson (USA). Dept. of Chemistry). 1988. Contract FG02-86ER13501. 39p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003065/JAW.

We have demonstrated the ability of our methods in photoelectron spectroscopy to provide detailed and independent information regarding the electronic interactions of organic molecules with transition metals. The fundamental interactions of C-H {sigma} and {sigma}{asterick} orbitals with a metal were illustrated in our study of the agostic CH-M interaction in (cyclohexenyl) manganese tricarbonyl. Study of the related methylallyl complexes allowed direct observation and measurement of the stabilization energy provided by the agostic interaction. Electronic and thermodynamic factors favoring {beta}-hydride addition to a metal enter have been revealed by our studies of niobocene and tantalocene complexes. In the study of metallocenes, detailed electronic structure features of osmocene have been obtained from the vibrational fine structure, spin-orbit splitting, and photoionization cross-sections that we have observed in the high-resolution photoelectron spectrum of this complex. We have also obtained important information on metal-methylene, metal-alkylidyne, and metal-heteroatom multiple bonding interactions and their influence on the chemistry of these species. We have established the ability to observe the electronic effects of intermolecular interactions by comparing the ionization of metal complexes in the gas phase with the ionizations of thin solid organometallic films prepared in ultra-high vacuum. 17 figs.

6223 **(DOE/PC/60812—T6) Catalysts possessing augmented C-O and C-N hydrogenolysis activity: Final progress report, August 1, 1983--July 31, 1987.** Massoth, F.E.; Shabtai, J.S. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 1987. Contract FG22-83PC60812. 115p. NTIS, PC A06/MF A01 - OSTI; 1; GPO Dep. Order Number DE88011256/JAW.

The objective of this project is to synthesize and investigate new sulfided catalyst systems having higher carbon-heteroatom hydrogenolysis activity as compared to ring hydrogenation activity. A fundamental approach is applied to gain understanding of the basic catalytic properties which relate to hydrogenolysis and hydrogenation functions of the catalysts. This involves preparation of new catalysts, characterization of their properties, and model compound reactivity studies. Selected catalysts are applied in studies of more complex O- and N-containing model compounds with the objective of providing fundamental data on the stereochemistry of hydrogenation, HDO and HDN reactions. These data are used to develop steric surface-reactant models for sulfided catalysts. This knowledge could be reasonably expected to allow for tailoring of selective sulfided catalysts possessing augmented C-O and C-N hydrogenolysis activity. Such new catalysts should be of particular importance for upgrading of coal-derived liquids and solids, as well as other heavy feedstocks. Research is divided into four tasks: A--catalyst preparation and activity testing; B--catalyst characterization; C--catalyst activity and functional selectivity under hydroprocess-

ing conditions; and D--stereochemical studies. Results are discussed. 30 refs., 15 figs., 16 tabs.

6224 **(DP—1765) Separation of ^{241}Am from calcium and lead using masking and multiple oxalate precipitation techniques.** Gray, L.W.; Burney, G.A.; King, C.M. (Savannah River Lab., Aiken, SC (USA)). Aug 1988. Contract AC09-76SR00001. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004139/JAW.

Savannah River Laboratory (SRL) and Savannah River Plant (SRP) have been separating actinides for more than 35 years. Work continues to upgrade processes and to initiate new processes. This report summarizes work to improve oxalate precipitation decontamination of ^{241}Am by use of masking agents. Ammonium nitrate was found to be an effective agent. It has been demonstrated to effectively retain both calcium and lead in solution during oxalate precipitation on both a laboratory and production scale. Other masking agents were tried with varying degrees of success. 28 refs., 3 figs., 11 tabs.

6225 **(IFP—36-167) Activation of the C-H bond: catalytic hydroxylation of hydrocarbons by new cobaltic alkylperoxydic complexes; selective and catalytic cycloalkane dehydrogenation in presence of uranium for hydrogen transfer.** Brazi, E. (Paris-6 Univ., 75 (France); Ecole Nationale Superieure du Petrole et des Moteurs (ENSPM), 92 - Rueil-Malmaison (France)). 1987. 190p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755658/JAW.

The aim of the thesis is to improve efficiency and selectivity of chemical reactions for alkane transformations. In the first part decomposition of hydroperoxides and hydrocarbon hydroxylation by cobalt complexes is studied. In the second part cycloalkanes are dehydrogenated into aromatics with a Pt catalyst, trapping hydrogen by uranium. Uranium hydride UH/sub 3/ can yield very pure hydrogen at reasonable temperature.

6226 **(INIS-XN—143) Predicted formation constants using the unified theory of metal ion complexation.** Brown, P.L.; Wanner, H. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). (Nuclear Energy Agency, 75 - Paris (France)). 1987. 102p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704564/JAW.

Formation constants are listed for standard conditions, i.e., 298.15K (25/sup 0/C), 10/sup 5/ Pa, and zero ionic strength for a number of species containing selected elements (Am, Cs, Np, Pa, Pb, Pd, Pu, Ra, Sn, Sr, Tc, Th, U) and ligands (hydroxide, fluoride, chloride, bromide, iodide, iodate, sulphate, ammonia, nitrate, hydrogen phosphate, dihydrogen phosphate, carbonate, bicarbonate, oxalate, formate, thiocyanate, acetate, benzoate, catecholate, ethylenediamine, glycinate, glycollate and phenolate) that have been considered important for nuclear technology. 16 refs.

6227 **(KFK—4449) Formation of titanium nitride layers on titanium metal: Results of XPS and AES investigations.** Moers, H.; Pfennig, G.; Klewe-Nebenius, H.; Penzhorn, R.D.; Sirch, M.; Willin, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie). Sep 1988. 65p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756109/JAW.

The reaction of titanium metal with gaseous nitrogen and ammonia at temperatures of 890/sup 0/C leads to the formation of nitridic overlayers on the metallic substrate. The thicknesses of the overlayers increase with increasing reaction time. Under comparable conditions ammonia reacts much slower than nitrogen. XPS and AES depth profile analyses show continuous changes of the in-depth compositions of the overlayers. This can be interpreted in terms of a very irregular thickness of the overlayers, an assumption which is substantiated by local AES analyses and by the observation of a pronounced crystalline structure of the substrate after annealing pretreatment, which can give rise to locally different reaction rates. The depth profile is also influenced by the broad ranges of stability of the titanium nitride phases formed during the reaction. The quantitative analysis of the titanium/nitrogen overlayers by AES is difficult because of the overlap of titanium and nitrogen Auger peaks. In quantitative XPS analysis problems arise due to difficulties in defining Ti 2p peak areas. This work presents practical procedures for the quantitative evaluation by XPS and AES of nitridic overlayers with sufficient accuracy.

6228 **(LBL—26010) Basicity of coordinating ligands in trivalent uranium and cerium metallocene complexes.** Fabiano, M.D. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 22p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002491/JAW.

Although much is known about the affinity of various Lewis bases for transition metal centers, the chemical literature contains only scant information about the relative affinities of Lewis bases for lanthanide and actinide metal centers. In terms of ligand affinities for f-metal centers, traditional HSAB theory characterizes trivalent and tetravalent f-metal cations as "hard" acids, preferring to be coordinated to "hard" Lewis bases (e.g., nitrogen or oxygen donor ligands) rather than "soft" (e.g., phosphorous or sulfur donor ligands) Lewis bases. Recent work by Brennan and Stults, however, has shown that, trimethylphosphine has a much greater affinity than does pyridine for the metal center in (MeC{sub 5}H{sub 4}){sub 3}U and in (MeC{sub 5}H{sub 4}){sub 3}Ce. This work established the ligand displacement series PMe{sub 3}, is quantitatively displaced by trimethylphosphine oxide in both the uranium and cerium systems. In the cerium system, trimethylphosphine sulfide and dimethyl sulfoxide were also found to quantitatively displace PMe{sub 3}. Trimethylphosphine oxide was found to be by far the strongest ligand in both systems, quantitatively displacing all ligands studied in both systems, with one exception: in the (me{sub 3}SiC{sub 5}H{sub 4}){sub 3}U system, t-butyl isocyanide is displaced, but not completely displaced, by OPME{sub 3}. 9 refs.

6229 (MLM—3521, pp 4-7) **Stable isotopes: Separation methods and applications.** Jul 1988. NTIS, PC A03/MF A01 - OSTI. Order Number DE88013959/JAW. Contract AC04-76DP00053.

In Technology Update - 88.

Stable isotopes, by virtue of differences in their atomic mass, exhibit unique properties that increasingly are being exploited for a variety of research uses and applications. Mound has been working to produce and distribute stable isotopes for nearly 35 years, and in the process, contributing products, services, technical information, and research that has made it a recognized world leader in this field. This article will look briefly at Mound's work in stable isotope separation, including the major processes used to enrich isotopes, the sales and marketing function, and the diverse uses of enriched stable isotopes. 2 refs., 4 figs., 1 tab.

6230 **(ORNL/M—500) Research programs for Division of Chemical Sciences, Office of Basic Energy Sciences, Department of Energy.** (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 41p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003693/JAW.

A chemical sciences review meeting was held in which research programs in chemistry were discussed. Major topics included: chemistry of actinides and fission products, interactions of solvents, solutes and surfaces in supercritical extraction, chemical and physical principles in multiphase separations, and chemical kinetics of enzyme catalyzed reactions. Individual projects are processed separately for the data bases. (CBS)

6231 **(SAND—88-2124C) Why does molten aluminum explode at underwater or wet surfaces?.** Nelson, L.S.; Eatough, M.J.; Guay, K.P. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 26p. (CONF-890215—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001045/JAW.

From Fall meeting of the Metallurgical Society; Las Vegas, NV, USA (27 Feb 1989).

Molten Al sometimes explodes when it inadvertently contacts a wet or underwater solid surface. With laboratory experiments, we investigated these initiations at seventeen different submerged surfaces. Surfaces nonwettable by liquid water were inert, while water-wettable surfaces initiated explosive molten Al-water interactions. We hypothesize that the water-wetted surfaces provide

a thin layer of liquid water beneath the molten Al that can heat rapidly during transient liquid-liquid contact between melt and water. Because the surfaces of the wettable solid and the molten metal are both presumed to be poor nucleators of bubbles, substantial superheating of the water layer may occur. The resultant vaporization may be explosive, causing local fragmentation of the melt and pressure disturbances that initiate steam explosions elsewhere where melt and water are adjacent. Nonwetted surfaces, on the other hand, are essentially dry beneath the melt and produce little assistance to the explosive interaction. 21 refs., 7 figs., 1 tab.

6232 **(SKB-TR—87-20) Stability fields of smectites and illites as a function of temperature and chemical composition.** Tardy, Y.; Duplay, J.; Fritz, B. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Sedimentologie et Geochimie de la Surface; Strasbourg-1 Univ., 67 (France). Inst. de Geologie). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Sedimentologie et Geochimie de la Surface). Apr 1987. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756164/JAW.

A thermodynamic ideal solid solution analogue is proposed which accounts the correlations which clearly reflect the temperatures at which the nonmineralic population are supposed to have been formed. The solid solution is considered, at a particle scale, as an ideal mixture of individual layers, weakly bent each to the next. Each layer presents the chemical composition of a given end member, so that the proportions of the different end members change from one particle to another. Considering one particle of a given chemical composition, the multipole solid solution theory allows to calculate the wheighted contributions of each end member into the ideal clay solid solution along with the chemical composition of the aqueous solutions in equilibrium with the considered particle in its independent microenvironment. This model is able to predict the nature of the chemical correlations which are expected, at a given temperature, within a given population. This model is also applied to the prediction of the temperature required for the conversion of smectite into illite during the burial diagenesis.

6233 **(SKB-TR—88-04) Ion binding by humic and fulvic acids: A computational procedure based on functional site heterogeneity and the physical chemistry of polyelectrolyte solutions.** Marinsky, J.A.; Reddy, M.M.; Ephraim, J.; Mathuthu, A. (Geological Survey, Lakewood, CO (USA). Denver Federal Center; Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society; State Univ. of New York, Buffalo (USA). Dept. of Chemistry). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; State Univ. of New York, Buffalo (USA). Dept. of Chemistry). Apr 1988. 59p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756089/JAW.

Ion binding equilibria for humic and fulvic acids are examined from the point of view of functional site heterogeneity and the physical chemistry of polyelectrolyte solutions. A detailed explanation of the potentiometric properties of synthetic polyelectrolytes and ion-exchange gels is presented first to provide the basis for a parallel consideration of the potentiometric properties exhibited by humic and fulvic acids. The treatment is then extended to account for functional site heterogeneity. Sample results are presented for analysis of the ion-binding reactions of a standard soil fulvic acid (Armadale Horizons Bh) with this approach to test its capability for anticipation of metal ion removal from solution. The ultimate refined model is shown to be adaptable, after appropriate consideration of the heterogeneity and polyelectrolyte factors, to programming already available for the consideration of ion binding by inorganics in natural waters.

6234 **(UJV—8311-CH,T) Uranium-plutonium fuel for thermal reactors.** Jakesova, L.; Havelka, S.; Hron, M. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Dec 1987. 42p. (In Czech). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704974/JAW.

A review is presented of available literature data on the physical, physico-chemical and radiation properties of the UO/sub 2/-PuO/sub 2/ system, important in respect of the use of the system as thermal reactor fuel. The techniques are described of mixed fuel preparation as are the methods of quality control, radiological aspects of the (U,Pu)O/sub 2/ application, the possibility of multiple plutonium recycling, and the existing experience with reactor applications. (author). 24 figs., 22 tabs., 84 refs.

6235 **Overtone spectra of C--H oscillators in cold molecules.** Crofton, M.W.; Stevens, C.G.; Klenerman, D.; Gutow, J.H.; Zare, R.N. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Chemical Physics;* **89**: No. 12, 7100-7111(15 Dec 1988).

The C--H stretch overtone spectra of methane (5--0), ethylene (5--0 and 6--0), ethane (5--0 and 6--0), propyne (4--0 and 5--0 acetylenic and 5--0 methyl C--H stretches), allene (5--0), propane (5--0 and 6--0), cyclopropane (5--0 and 6--0), dimethyl ether (5--0), and isobutane (5--0) have been recorded at temperatures between 143 and 189 K, depending on the molecule. A comparison is made to the spectra obtained at room temperature, with the goal of improved understanding of the band shapes. The temperature dependence of most of the observed bands is found to be significantly less than that expected for "simple" bands. For these small to medium size hydrocarbons, the temperature independence of the overtone bands is found to correlate loosely with the density of states and with the degree of saturation. Other factors are important determinants of spectral widths and temperature independence as well, such as conformational inequivalence of the C--H oscillators, and the number and positions of the oscillators. It is concluded that the vast majority of hydrocarbon C--H stretch high overtone bands have upper states which are extensively mixed with other states. This is the case even for most of the relatively small hydrocarbons. This mixing produces a broadening effect and greatly increases the transition density, thereby diluting the oscillator strength of the rovibrational transitions from that of the zero-order approximation. The Fermi resonance type of interaction appears to be of greater importance than the Coriolis type in determining the appearance of the high overtone bands.

6236 **Lifetime of the A {sup 2}{Sigma}{sup +}, v' = 0 level of HS measured using the Hanle effect.** Loge, G.W.; Tiee, J.J. (Chemical and Laser Sciences Division, Los Alamos National Laboratory, MS J567, P.O. Box 1663, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **89**: No. 12, 7167-7171(15 Dec 1988).

H{sub 2}S was photodissociated using an ArF excimer laser at 193 nm to form HS photofragments. LIF spectra of HS in the region of 324 nm were obtained using a pressure tuned dye laser with improved resolution of the R{sub 1} and /sup R/Q{sub 21} branches in the A {sup 2}{Sigma}{sup +}left-arrowX {sup 2}Pi{sub 3}/sub //{sub 2} transition. The zero field linewidths and the Zeeman splitting of the /sup R/Q{sub 21} (1.5) line in a magnetic field were obtained. The latter was used to verify the g values expected for a Hund's case (b) {sup 2}{Sigma}{sup +} upper state and Hund's case (a) {sup 2}Pi lower state. Depolarization of fluorescence in a magnetic field using the /sup R/Q{sub 21} (3.5) line with {sigma}polarized LIF excitation was used to determine an estimated lifetime of 0.15--0.3 ns for the lowest vibrational level of the {sup 2}{Sigma}{sup +} state. A lower limit on the lifetime of 0.17 ns was determined from the measured adsorption linewidths. No rotational dependence on the linewidth was observed.

6237 **Sedimentation and dispersion of Brownian particles in spatially periodic potential fields.** Nitsche, J.M.; Brenner, H. (Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Journal of Chemical Physics;* **89**: No. 12, 7510-7520(15 Dec 1988).

A generalized Taylor dispersion analysis is presented of the combined diffusion and sedimentation of a Brownian particle subjected to a spatially periodic potential plus a uniform force. At long times this transport process is macroscopically characterized by a uniform mean drift velocity vector of the Brownian particle, and by a dispersion dyadic that quantifies stochastic "spreading" about the (traveling) mean position. A general explicit integral formula is derived for the dispersion coefficient in the one-dimensional case,

which supplements known results for the mean velocity. Illustrative calculations show that, for sufficiently large values of the drift force, the dispersivity exceeds the molecular diffusivity, which characterizes dispersion in the absence of any potential barriers. These calculations also lead to the surprising conclusion that an increase in the height of the potential barriers can sometimes lead to an increase in the dispersivity. A general asymptotic analysis is developed for the limiting case where the drift force tends to infinity. Although in one dimension the dominance of the drift force over the potential leads to a spatially uniform, steady-state, periodic distribution, the same behavior does not generally obtain in higher-dimensional cases. Asymptotic expressions are derived for the mean velocity and dispersivity characterizing one-dimensional systems and a class of two-dimensional systems. The analysis is subsequently applied to the related problem of sedimentation and dispersion of a particle within a medium for which its molecular diffusivity is a periodic function of position (in the absence of any potential).

6238 **Stochastic simulation of the Boltzmann equation for the Lorentz gas.** Palmer, B.J.; Keyes, T. (Department of Chemistry, Boston University, Boston, Massachusetts 02215). *Journal of Chemical Physics;* **89**: No. 12, 7531-7541(15 Dec 1988).

We propose a stochastic simulation for solving the Boltzmann equation for the Lorentz gas and develop a formalism to rigorously show the equivalence between the simulation and the Boltzmann equation. We also propose several simple simulations which offer a substantial improvement over the Boltzmann equation and discuss the simulations in the context of repeated ring equations.

6239 **Interaction of hexafluoroazomethane with Si(111).** McFeely, F.R.; Yarmoff, J.A.; Beach, D.B. (IBM T. J. Watson Research Center, P. O. Box 218, Yorktown Heights, New York 10598). *Journal of Chemical Physics;* **89**: No. 12, 7609-7614(15 Dec 1988).

Chemisorption of hexafluoroazomethane on Si(111) was studied with synchrotron photoemission as a model system for studies of halocarbon-based etching. C 1s, N 1s, and F 1s core level spectra were collected for various room temperature exposures of clean silicon to hexafluoroazomethane, and after mild annealing. The initial reaction of hexafluoroazomethane with silicon is shown to be quite complex, resulting in the formation of many adsorbed dissociation products. Annealing resulted in the desorption and decomposition of these species. These results demonstrate the buildup of a passivating carbon layer on the silicon samples, which may be responsible for the inability of CF/sub x/ radicals to etch silicon effectively.

4005 Photochemistry

REFER ALSO TO CITATION(S) 6272

6240 **Photoionization mass spectrometric studies of AsH/sub n/ (n = 1--3).** Berkowitz, J. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **89**: No. 12, 7065-7076(15 Dec 1988).

The photoion yield curves of the free radicals AsH and AsH{sub 2}, prepared by the reaction of H atoms with AsH{sub 3}, have been measured. The adiabatic ionization potential of AsH (forming AsH{sup +}, X {sup 2}Pi{sub 1}/sub //{sub 2}) is 9.641 +- 0.008 eV. Autoionizing Rydberg states are observed and analyzed to converge to an a {sup 4}{Sigma}{sup -} state lying 1.94 eV higher in energy. The adiabatic ionization potential of AsH{sub 2} (forming AsH{sup +}{sub 2}, X {sup 1}A{sub 1}) is 9.443 +- 0.007 eV. The {sup 3}B{sub 1} state of AsH{sup +}{sub 2} is conservatively estimated from the spectrum to lie 0.60--1.46 eV higher in energy, with the lower figure expected to be close to the true value. In addition, the ion yield curves of AsH{sup +}{sub 3}, AsH{sup +}{sub 2}, and AsH{sup +} from photoionization of AsH{sub 3} have been measured. From these measurements, the adiabatic ionization potential of AsH{sub 3} is 9.82 +- 0.01 eV, the appearance potential of AsH{sup +}{sub 2} (+H) is 12.69 +- 0.01 eV, and that of AsH{sup +}(+H{sub 2}) is 11.295 +- 0.05 eV. The latter two measurements, when combined with the corresponding ionization potentials, yield D{sub 0}(H{sub 2}As--H) = 74.9 +- 0.2 kcal/mol and D{sub 0}(HAs--H) = 66.5 +- 0.2 kcal/mol. The value of D{sub 0}(As--H), as deduced from these measurements, depends upon an accurate heat of atomization of AsH{sub 3}, which in turn requires an accurate value for {Delta}/sup circle-open//sub f//sub =/ (As,g). An analysis of alternative values is presented, from which D{sub 0}(As--H) = 64.6 +- 0.7 kcal/mol (2.80 +- 0.03 eV) is obtained.

4006 Radiation Chemistry

6241 **(CEA-CONF—9586) Reduction of nitroheterocyclic derivatives of pharmacological interest. Study intermediary nitroradicals by pulse radiolysis.** Hickel, B.; Henry, Y.; Guissani, A.; Lougmani, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (FR). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Centre National de la Recherche Scientifique, 75 - Paris (FR). Inst. de Biologie Physico-Chimique). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 1p. (In French). (CONF-8806286—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755620/JAW.

From Meeting on radiation chemistry; Marly-lo-Roi, France (14 Jun 1988).

6242 **Electron degradation and yields on initial products. II. Subexcitation electrons in molecular nitrogen.** Kowari, K.; Kimura, M.; Inokuti, M. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **89**: No. 12, 7229-7237(15 Dec 1988).

Subexcitation electrons lose their kinetic energy through vibrational excitation, rotational excitation, and elastic collisions in molecular gases. Initial yields of vibrationally and rotationally excited states of nitrogen molecules are calculated by using the Spencer--Fano equation (SFE) and its simplification, the continuous-slowing-down approximation (CSDA), both in time-independent and time-dependent representations. One focus of the present study is a close comparison of the CSDA with the rigorous treatment of the SFE in the subexcitation domain. The present result reveals for the first time distinct energy regions in which either vibrational excitation or rotational excitation dominates. This recognition explains the different time dependence of the yields of vibrational and rotational excitation.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 5915, 6226, 6448

6243 **(ORNL/M—551) Isotopes: Products and services.** (Oak Ridge National Lab., TN (USA)). Jun 1988. Contract AC05-84OR21400. 208p. NTIS, PC A10/MF A01 - OSTI. Order Number DE89001393/JAW.

The US Department of Energy (USDOE) provides the isotopic materials and services listed in this catalog for distribution by sale through the Oak Ridge National Laboratory Isotope Distribution Office (ORNL/IDO) which is operated for the USDOE by Martin Marietta Energy Systems, Inc. Materials available include separated stable isotopes, byproduct radioisotopes, and research quantities of source and special nuclear materials. Isotope products are routinely available in the forms listed in the product description section of this catalog. Different forms can be provided in some cases, usually at additional cost. Routinely available services include fabrication of special physical forms, source encapsulation, ion implantation, and special purifications. Materials and services that are not offered as part of the routine distribution program may be made available on an individual basis as approved by the USDOE if they are not available from private, domestically owned producers in the United States.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

6244 **(DOE/ER/10677—9) Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels: Progress report for period February 16, 1984--February 15, 1985.** Merklin, J.F.; Sorensen, C.M. (Kansas State Univ., Manhattan (USA)). Mar 1985. Contract AC02-80ER10677. 19p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003040/JAW.

The study of the shock tube pyrolysis of toluene was studied. Initial results show that benzene was the major product at low temperatures. This study is being continued. The concentration profiles of the major products in fuel-rich premixed CH_4/O_2 flames have been measured. Optical measurements were performed to measure soot number densities, volume fraction and particle size distributions. We have shown that the increase in the soot volume fraction is due to surface growth and acetylene is the source of carbon involved in this process. 11 refs., 12 figs., 1 tab.

6245 **(NP—9770109) Effects of turbulence induced by obstacle structures and flame front superposition on deflagrative explosion processes in atmospheric hydrocarbon/air clouds. Final report.** Leuckel, W.; Christill, M.; Nastoll, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1988. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770109/JAW.

The effects of turbulence on flame diffusion were discussed in detail, with particular regard to two important mechanisms of turbulence generation, i.e. flow around obstacle structures and flame front superposition. The experiments were carried out on two experimental containers with shockproof walls. One was a square duct with a length of 4 m (0.25 x 0.25 m in diameter) for turbulence generation by means of obstacles, the other a cylindrical vessel with a volume of 1 m/sup 3/ for flame front interference experiments. The combustion gases were methane/air mixtures with different compositions and reaction rates.

42 ENGINEERING

REFER ALSO TO CITATION(S) 7186

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 5792, 5794, 5960, 6080, 6126, 6178, 6302, 6392, 7110

6246 **(BDX—613-3987) Analysis of multiple vendor cartridge filters: Final report.** Youngberg, D.A. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Nov 1988. Contract AC04-76DP00613. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004434/JAW.

A study was performed to determine the most efficient and economical 0.2 μm filter cartridges for use in pure water applications at Allied-Signal Inc., Kansas City Division (KCD). Eight cartridges were evaluated for weight gain and volume filtered; calculations were performed to standardize the data. Five cartridges were found to exhibit the qualities desired for the KCD pure water applications. 7 tabs.

6247 **(CONF-880812—28) A simple method for preparing superconducting high T/sub c/ thin films.** Romano, P.; Nigro, A.; Vaglio, R.; Signorelli, E.; Gray, K.E. (Salerno Univ. (Italy). Dipt. di Fisica; Consiglio Nazionale delle Ricerche, Cinisello Balsamo (Italy); Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number TI89003663/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

High quality superconducting thin films of the high Tc compound $YBa_2Cu_3O_7$ have been prepared on sapphire using a new, simple method that combines d.c. magnetron sputtering from a single target and evaporation from a heated source. The method should be especially suitable for depositing thin films on complex surfaces. YBa_2Cu_3O/sub 7-∂/ films with Tc=92K (onset) were prepared using an YCu_3 target and evaporating barium by a specially designed, feedback controlled, molybdenum heater using both pure barium or a barium-aluminum alloy. The films were characterized by x-rays, Electron Dispersion Spectroscopy and other techniques. 7 refs., 2 figs.

6248 **(DOE/BP—1038) Superconductivity applications on an electric power system: A system engineering study.** Myers, W.E.; Taylor, C.W.; Pachot, J.J.; Hartmann, D.P.; Fuller, N.E.; Hauer, J.F.; Vithayathil, J.J.; Matheson, D.R.; Starr, E.C.; Schaufelberger, C.L. (Bonneville Power Administration, Portland, OR (USA)). Aug 1988. 74p. NTIS, PC A04/MF A01. Order Number DE89003505/JAW.

The recent discoveries in superconductivity have raised both questions and exciting expectations about applications in the electric power industry. This report addresses these questions in general and for the Bonneville Power Administration and the Pacific Northwest power system in particular. During early discussions, we decided that an important part of the report would be a description of modern conventional power equipment that are candidates for replacement by superconducting equipment. Also, power system characteristics and requirements would be analyzed. The developments and promises of high temperature superconductors would be evaluated to formulate a BPA role or strategy in developing, demonstrating, and applying superconducting power equipment. 101 refs., 13 figs., 10 tabs.

6249 **(DOE/ET/10815—T6) Industrial safety and fire protection appraisal report, July 18-21, 1988.** (Tennessee Univ., Tullahoma (USA). Space Inst.). 1988. Contract AC02-79ET10815. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number TI89003043/JAW.

The industrial safety programs reviewed during this appraisal have been found to be excellent. There has been significant improvement in the documentation and tracking of the industrial safety programs. The fire protection programs reviewed during this appraisal have been found to be good. Five recommendations were made as a result of this appraisal. Recommendations were made to establish a schedule to inspect and test the fire detection system in accordance with NFPA Standards, provide emergency telephone numbers at all telephones, establish and implement a program to annually inform their employees of their rights to file safety concerns with DOE, maintain an up-to-date set of the National Fire Codes, and complete the 10 items on the attached Deficiency List.

6250 **(JAERI-M—88-080) Numerical simulation of human biped locomotion. Computer program for solving robotics equations and for representing the walking image.** Ishiguro, Misako; Fujisaki, Masahide. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Apr 1988. 74p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755501/JAW.

This report describes the numerical simulation of the motion of human-like robot which is one of the research theme of human acts simulation program (HASP) begun at the Computing Center of JAERI in 1987. The purpose of the theme is to model the human motion using robotics kinematic/kinetic equations and to get the joint angles as the solution. As the first trial, we treat the biped locomotion (walking) which is the most fundamental human motion. We implemented a computer program on FACOM M-780 computer, where the program is originated from the book of M. Vukobratovic in Yugoslavia, and made a graphic program to draw a walking shot sequence. Mainly described here are the mathematical model of the biped locomotion, implementation method of the computer program, input data for basic walking pattern, computed results and its validation, and graphic representation of human walking image. Literature survey on robotics equation and biped locomotion is also included.

6251 **(LA—11324-M) HTPIPE: A steady-state heat pipe analysis program: A user's manual.** Woloshun, K.A.; Merrigan, M.A.; Best, E.D. (Los Alamos National Lab., NM (USA)). Nov 1988. Contract W-7405-ENG-36. 100p. NTIS, PC A05 - OSTI. Order Number DE89003791/JAW.

A steady-state heat pipe analysis program, HTPIPE, operational on CRAY computers, is documented. HTPIPE has two input/output (I/O) options: pressure and temperature profiles along the heat pipe, and calculation of performance limits. Pressure and temperature profiles are calculated based on user-specified boundary conditions, which may be any two of the following: power throughput, evaporator exit temperature, source temperature, and sink temperature. The performance limits represent the maximum heat transport limits at a specified evaporator exit temperature. The calculated performance limits are the capillary, viscous, sonic, entrainment, and boiling limits. User input is interactive, with the available option of parametric variation during a single program execution to facilitate heat pipe design optimization. The hydrodynamic model is described. Program I/O is detailed and supplemented with examples. A program listing and a flow chart are included in this manual. HTPIPE is consistent with the theories and correlations used for heat pipe design at Los Alamos National Laboratory to date. 13 refs., 2 figs., 3 tabs.

6252 **(LA—11391-MS) Advancements in thermal spallation drilling technology.** Williams, R.E.; Dey, T.; Rauenzahn, R.; Kranz, R.; Tester, J.; Potter, R.; Murphy, H. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 39p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002095/JAW.

Thermal spallation of hard rocks has been used commercially for many years to cut granite in quarries and to produce blasting holes in taconite mines. It is potentially an economic process for creating cavities in hard rocks that are difficult to drill or mine by conventional methods. These cavities might have application for storage of liquids and gases and of energy in several forms. They may also be used as high-pressure, naturally heated retorts for certain chemical processes. This report describes the spallation process, including the fluid dynamics and heat transfer from flame jets to the rock and subsequent rock failure. Our model of the spallation process predicts with good accuracy the surface temperatures and heat-transfer rates required to maintain desired drilling rates. Field tests, including site selection, equipment, field operations, and accomplishments, are also described in detail. 31 refs., 13 figs., 1 tab.

6253 (MLM—3521, pp 19-21) **Robotic measurement and sorting of percussion primers.** Thomas, J.A. Jul 1988. NTIS, PC A03/MF A01 - OSTI. Order Number DE88013959/JAW. Contract AC04-76DP00053.

In Technology Update - 88.

Mound procures various commercially available parts for incorporation into its manufactured products. Close inspection of these purchased items is an integral part of the quality built into a final product. A successful inspection procedure has been developed using a robot that places pill-sized parts on a rotary table and then removes and sorts them after an automatic height gauge measurement. 3 figs.

6254 **(ORNL/TM—10864) Design guidelines for remotely maintained equipment.** Burgess, T.W.; Evans, J.H.; Peishel, F.L.; Schrock, S.L.; Smith, G.E.; Macdonald, D. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 112p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89004309/JAW.

The CFRP has pioneered and developed the concept of totally remote operation and maintenance of process equipment in spent fuel reprocessing, using force-reflecting master/slave servomanipulators, coupled with television viewing, to extend human capabilities effectively throughout an uninhabitable environment. This concept enhances safeguard control of nuclear materials, provides for low-exposure of personnel to radiation and reliable recovery from unplanned events, ensures high plant availability, and aids eventual decommissioning of the plant. The results of this experience have been organized in this document to enable designers to consider this technology, not only in spent fuel reprocessing, but among various other situations that may be hazardous to personnel. This document is an expanded and updated version of an earlier design guide that was specific to fuel reprocessing requirements. The guidelines identified in the present document suggest a general approach to the design of effective, reliable, safe, remotely operated and maintained facilities. This document may be used broadly to apply remotely maintained equipment in hostile environments based on proven techniques, equipment, and well-established practices. The concepts are particularly applicable to large plant facilities where economy of scale is important. The theme emphasizes utilization of ordinary commercial tools, equipment, and materials widely available. 5 refs., 51 figs., 10 tabs.

6255 **(ORNL/TM—10935) Object recognition for the HERMIES robot.** Bowyer, K.W. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 35p. (CESAR—88/55). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004259/JAW.

The HERMIES-IIB robot in the CESAR lab at ORNL is used in research related to vision, multi-sensor integration, coordinated arm movement, path planning, parallel algorithms, and learning. This report describes the development of a visual object recognition system for HERMIES. This system is implemented on an NCube system, an MIMD hypercube parallel computing system. In general, the input to the object recognition system will be an image containing one or more instances of the known different types of obstacles, and the output will be the location(s) of the obstacle(s) relative to the cameras. Based on assumptions about the known geometry of the obstacles, the viewing conditions, the relevant range of viewing distances and the image resolution needed, it is proposed that the obstacles can be recognized by the presence of roughly rectangular outlines in the image. The object recognition system uses Hough transforms to find rectangular outlines in the image, and then uses a sequence of constraints to eliminate those outlines which could not be due to obstacles. 7 refs., 4 figs.

6256 **(ORNL/TM—10952) A model for estimating evaporation rate in fixed-roof JP-4 fuel storage tanks: Final report.** Daw, C.S.; Chen, N.C.J. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004261/JAW.

This report describes a mathematical model that simulates the evaporation of JP-4 fuel in fixed-roof storage tanks. The model is based on fundamental mass-transport processes, thus minimizing the need for empirical parameters. Model predictions are summarized both graphically and algebraically, making it possible to readily estimate the evaporation rate for specific cases. The model predictions are shown to compare favorably with previous field observations. The model also confirms that JP-4 storage tank emissions are usually well below saturation. 16 refs., 11 figs.

6257 **(PNL—6708) Tethersonde and kite anemometer evaluation.** Chow, W.Y.; Kirchhoff, R.H. (Pacific Northwest Lab., Richland, WA (USA); Massachusetts Univ., Amherst (USA)). Oct 1988. Contract AC06-76RL01830. 121p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89003723/JAW.

The responses of kite anemometers and tethersonde balloons to the dynamics of the wind are investigated in this study. A three-phase effort of theoretical development, experimental measurement, and comparison of data and theory was undertaken to provide further understanding of how a kite or balloon responds to atmospheric turbulence. Understanding the effect on wind velocity measurements obtained using these instruments is important to their use in, for example, identifying optimum wind turbine sites. The theoretical development included: (1) an extension of double theodolite theory, to provide a mechanism for calculating instrument displacement, and (2) linear small perturbation analysis of the effect of atmospheric turbulence on kite or balloon motion. The results of the small perturbation analyses were response equations that analyze the movement of the kite or balloon as a function of the mean elevation angle of the kite or balloon and turbulence parameters of the wind. The response equations provide the ratio of the fluctuating string tension to the mean string tension (for the kite) and the fluc-

tuating elevation angle for the kite and balloon. 18 refs., 66 figs., 22 tabs.

6258 **(SAND—88-1915) An analysis of the risks and consequences of accidents involving shipments of multiple Type A radioactive material packages.** Finley, N.C.; McClure, J.D.; Reardon, P.C. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 73p. (TTC—0819). NTIS, PC A04/MF A01 - OSTI. Order Number DE89002498/JAW.

This report presents the results of an evaluation of the probabilities and consequences of accidents involving shipments of radioactive materials (RAM) contained in multiple Type A packages. On the basis of previous studies as well as highway and air accident experience, the exposure doses from three generic multiple-package shipments (High Activity, DOT Exemption, and Common Carrier) are estimated for incident-free transport and dose and probability are estimated for vehicular accidents, using the RADTRAN III risk calculation code. 15 refs., 10 figs., 14 tabs.

6259 **(SAND—88-2683) Data listing and plotting software for use with a LeCroy 9400 digital oscilloscope.** Searls, C.A. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 77p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004666/JAW.

Software to retrieve raw waveform data from a LeCroy 9400 oscilloscope and store it unconverted to IBM-PC compatible disk files was written by the Sandia Photometrics Division. This software provided a rudimentary plotting capability, but had no provision for making the data available to other analysis software. To provide this data interface a data access software package was written which reads the data from the disk files, performs the necessary scaling conversions, and provides for trace averaging and disk output using a file format which has a greater compatibility with existing analysis software. A graphics software package was also developed to provide a display and preview capability for the oscilloscope data. Two programs, LCLIST and LCPLOT, are given which provide examples of using the data acquisition software to read the data files, and in the case of LCPLOT, to plot the oscilloscope data.

6260 **(SAND—88-2787) SHRINK: A program for reducing the size of digitizing oscilloscope records.** Barker, L.M. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 23p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004667/JAW.

A program (SHRINK) is described which allows the user to quickly plot very large data files from digitizing oscilloscopes. The program also allows the deletion of parts of the data, and the filtering of other parts to any desired degree. Thus, SHRINK facilitates the condensation of huge data files to much more manageable sizes without the loss of any useful information. It has been particularly valuable in the reduction of VISAR data collected on digitizing oscilloscopes. 2 refs.

6261 **(SAND—88-2907C) The PVF2 piezoelectric polymer shock stress sensor signal conditioning and analysis for field test application.** Reed, R.P.; Greenwoll, J.I. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 31p. (CONF-8811100—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003276/JAW.

From 5. state-of-the-art blast instrumentation; Albuquerque, NM, USA (15 Nov 1988).

The newly perfected PVF2 piezoelectric polymer shock stress sensor has greatly expanded the range of piezoelectric shock stress measurement. It extends the typical 50 kbar amplitude and 3 μs duration measurement limit of the classic quartz gauge to about 500 kbar amplitude and durations limited by experiment rather than sensor design. It is becoming the shock stress sensor of choice in diverse laboratory and field applications. This paper describes some unfamiliar characteristics of the PVF2 shock stress sensor and a field-validated hybrid approach to the general measurement problem as encountered under typical field conditions. The approach combines (1) the physical components that are intrinsic to the measurement (e.g., the sensor, transmission link, recorders) (2) complementary signal conditioning hardware (physical filters, compensators), and (3) complementary software components (digital filters). The paper describes the overall measurement process from estimation of the PVF2 signal voltage to be recorded, through corrections of system characterizations and design of special filter characteristics for recording and analysis, to the final reduction of observed voltage to actual stress experienced by the sensor. 10 figs., 9 refs., 1 tab.

6262 **(SAND—88-2995C) Exterior alarm systems.** Williams, J.D. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 26p. (CONF-8811102—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002333/JAW.

From 1. international conference on industrial and high-risk places security; Turin, Italy (9 Nov 1988).

Industrial and high-risk facilities which require physical protection systems are usually those in which very valuable material, potentially dangerous material, or strategic information is stored. The primary purpose of physical protection systems for such areas is to prevent theft or sabotage of the protected items. The exterior alarm system is one of the essential elements of a physical protection system. The purpose of this paper is to present information about selecting, procuring, evaluating, installing, and maintaining a number of types of exterior alarm systems. 15 figs., 1 tab.

6263 **(UCID—21545) Experimental determination of the gage factor of a post-yield strain gage.** Hunter, J.R. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003713/JAW.

Experiments were performed to determine the gage factor of a post- yield strain gage as a function of strain. The gage factor was found to increase with increasing strain. A linear expression was found to adequately describe the change of gage factor as a function of strain. The expression for gage factor as a function of strain was incorporated into the bridge output equation for the single active arm Wheatstone bridge. The resulting expression allows accurate determination of strains up to 15 percent. 3 refs., 5 figs.

6264 **(UCRL—99235) Microcomputer simulation of a gas-driven free-piston pump.** Whitehead, J.C. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 6p. (CONF-890128—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89001357/JAW.

From Society for Computer Simulation western multiconference; San Diego, CA, USA (4 Jan 1989).

The dynamics of a gas-driven free-piston liquid pump were analyzed by microcomputer simulation prior to design and fabrication of a prototype pump. Custom valve specifications, sizing of fluid passageways, and other design details were based on FORTRAN simulations run on a 1 Mbyte Apple Macintosh Plus. The pump consists of coaxial cylinders for pressurized gas and the pumped liquid, with a single free piston which seals both chambers. At the end of a pumping stroke, inertia continues to drive the piston forward after the gas pressure has decreased, exposing a large circumferential exhaust port area. The operation of this passive gas exhaust valve was optimized by adjusting the exhaust port geometry, liquid and piston inertias, and other simulation parameters prior to dimensioning the physical parts. The structure of the simulation code is explained, and simulation run times are given. The complementary capabilities of Macintosh software for text editing, FORTRAN compilation, and scientific plotting are explained in the context of interactive time domain simulations for practical computer aided engineering. Measurements of gas and liquid pressure in the two bores of a prototype pump were made using a data acquisition system operated through the Macintosh. The experiments validate the computer model in low pressure operation, confirming that the pump provides a steady forward flow with a relatively short exhaust time. 5 figs., 2 tabs.

6265 **Modular multimorphic kinematic arm structure and pitch and yaw joint for same.** Martin, H.L.; Williams, D.M.; Holt, W.E. (to Dept. of Energy). US Patent Application 6-041,025. 21 Apr 1987. 29p. Contract AC05-84OR21400. DE89000222 NTIS, PC A03/MF A01 - OSTI. Order Number DE89000222/JAW.

A multimorphic kinematic manipulator arm is provided with seven degrees of freedom and modular kinematic redundancy through identical pitch/yaw, shoulder, elbow and wrist joints and a wrist roll device at the wrist joint, which further provides to the manipulator arm an obstacle avoidance capability. The modular pitch/yaw joints are traction drive devices which provide backlash free operation with smooth torque transmission and enhanced rigidity. A dual input drive arrangement is provided for each joint resulting in a reduction of the load required to be assumed by each drive means and providing selective pitch and yaw motions by control of the relative rotational directions of the input drive means. 12 figs.

4203 Lasers

6266 **(LA-UR—88-3881) Simulation codes for modeling free-electron laser oscillators.** Goldstein, J.C.; McVey, B.D.; Tokar, R.L.; Elliott, C.J.; Schmitt, M.J.; Carlsten, B.E.; Thode, L.E. (Los Alamos National Lab., NM (USA)). [1988]. Contract W-7405-ENG-36. 11p. (CONF-890143—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003579/JAW.

From SPIE/SPSE symposium on electronic imaging: advanced devices and systems; Los Angeles, CA, USA (15 Jan 1989).

This paper reviews the basic characteristics of free-electron laser (FEL) oscillators, and describes a group of codes that have been developed to analyze and design rf-linac-driven FELs. The optical performance of an FEL has been treated using 1-D time-dependent (finite pulse) codes that describe the characteristics of the optical temporal pulse shape and spectrum during the evolution of the oscillator from, low-intensity small-signal gain conditions to high-intensity large-signal gain conditions. These codes can include frequency-dependent elements, such as narrow-band filters or grating rhombs. Diffraction effects, transverse optical and electron-beam mode properties, misalignments, as well as aberrations on optical elements are modeled with the 3-D code FELEX. This code has now been extended to include effects of imperfections in the wiggler magnetic field and light emission at higher optical harmonics. A separate accelerator modeling capability allows the use of a numerically-generated electron pulse in FELEX for 3-D integrated numerical FEL simulations. 26 refs., 10 figs.

6267 **Two-photon excitation of dense sodium vapor near the nd {sup 2}D/sub 5/2,//sub //sub 3/2/ (n = 3, 4, 5) levels: Na{sub 2} 1 {sup 3}{Sigma}{sup +}/sub g/{yields}1 {sup 3}{Sigma}{sup +}/sub u/ excimer emission.** Bajic, S.J.; Compton, R.N.; Stockdale, J.A.D.; Konowalow, D.D. (Department of Chemistry, The University of Tennessee, Knoxville, Tennessee 37996). *Journal of Chemical Physics;* **89**: No. 12, 7056-7064(15 Dec 1988).

Laser excitation and ionization processes in dense (1--10 Torr) sodium vapor have been studied for laser wavelengths near the two-photon allowed nd {sup 2}D(n = 3, 4, 5) and ns {sup 2}S(n = 4, 5, 6) states. In particular, the 1 {sup 3}{Sigma}{sup +}/sub g/{yields}1 {sup 3}{Sigma}{sup +}/sub u/ excimer emission in Na{sub 2}, predicted in 1980 by Konowalow and Julienne and observed recently by Dinev et al, was studied here in greater detail. Strong excimer emission ({similar←to}30 nm) was observed for two-photon pumping to both sides of the unresolved 4D states, and weak excimer emission was seen when pumping near the 5D levels. The excimer emission exhibits a complicated pump laser profile with a pronounced "dip" at the 4d {sup 2}D two-photon resonance. Similarly, [2+1] photon ionization via the 3d {sup 2}D and 4d {sup 2}D states shows a dramatic decrease as the sodium density increases. These results can be attributed either to depleted 3d {sup 2}D or 4d {sup 2}D population due to stimulated electronic Raman scattering (SERS) or to the interference effects recently reported by Malcuit et al. and Krasnikov et al. and treated theoretically by Manykin and Afanas'ev and by Agarwal. It is argued that both mechanisms are operative.

6268 **Thermo-optic properties of gadolinium garnet laser crystals.** Hoefer, C.S.; Kirby, K.W.; DeShazer, L.G. (Hughes Research Laboratories, 3011 Malibu Canyon Road, Malibu, California 90265). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 11, 2327-2332(Nov 1988).

The indices of refraction, thermal variations of refractive indices, and thermal expansion coefficients were measured for the gadolinium garnets Gd{sub 3}Sc{sub 2}Ga{sub 3}O/sub 12/ (GSGG) and Gd{sub 3}Sc{sub 2}Al{sub 3}O/sub 12/. The variation of these properties with trivalent chromium doping was investigated for GSGG. The refractive indices were determined by the minimum-deviation technique, with indices fitted to a five-parameter Sellmeier formula. The thermal coefficients were measured by an interferometric technique using simultaneous Twyman–Green and Fizeau interferometry.

6269 **Generation of infrared and extreme-ultraviolet radiation in krypton with picosecond irradiation at 193 nm.** Shahidi, M.; Luk, T.S.; Rhodes, C.K. (Laboratory for Atomic, Molecular, and Radiation Physics, Department of Physics, University of Illinois at Chicago, P.O. Box 4348, Chicago, Illinois 60680). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 11, 2386-2394(Nov 1988).

The nonlinear interaction of neutral krypton atoms with picosecond 193-nm radiation with intensities $\leqq$0/sup 13/ W/cm^2 has been studied. Because of the relatively high intensity of the applied radiation field and the two-photon resonance of the 4p–6p transition, several competing nonlinear processes were observed that result in the generation of coherent radiation. Amplified spontaneous emission (ASE) from the two-photon-resonant level was observed in the IR frequency at {similar←to} μm. Additionally, a tunable IR wave, in the same frequency range, was generated by stimulated hyper-Raman scattering of the incident laser. The observed self-generated IR waves induced other nonlinear interactions, which resulted in the generation of extreme-ultraviolet (XUV) radiation in the same medium. Tunable XUV frequency was shown to be generated by four-wave sum mixing of the laser and the hyper-Raman wave. Vacuum-ultraviolet frequency was shown to be generated by four-wave oscillation, and other nontunable XUV frequencies resulted from anti-Stokes Raman scattering of the ASE IR waves.

6270 **Applications of microfabrication technology to x-ray laser cavities.** Hawryluk, A.M.; Ceglio, N.M.; Stearns, D.G. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* **6**: No. 6, 2153-2157(Nov 1988).

We have fabricated new, efficient x-ray optical components (x-ray mirrors, beamsplitters, and highly dispersive multilayer mirrors) and have used them to build an x-ray laser cavity. With our laser cavity, we have demonstrated multipass amplification of soft x rays with significant enhancement (>20 x) of the x-ray laser emission. This is an important first step in the ultimate conversion of x-ray amplifier media into true x-ray lasers with optimized coherence and divergence properties. We used advanced microfabrication techniques to fabricate the key laser cavity components which require precise layering of alternating materials, thin-film membrane technology, and precise patterning. The x-ray laser requirements, fabrication details, and characterization results for these cavity components are discussed.

6271 **Theory of a free-electron laser with a Gaussian optical undulator.** Gallardo, J.C.; Fernow, R.C.; Palmer, R.; Pellegrini, C. (Brookhaven National Lab., Upton, NY (US)). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **24**: No. 8, 1557-1566(Aug 1988).

The authors present theoretical studies of the possibility of a free-electron laser in the XUV and soft X-ray region of the spectrum, using a counterpropagating CO/sub 2/ laser beam as an undulator. A one-dimensional model is used to evaluate the single-pass power gain of such a device. The detrimental effects due to the energy spread, emittance of the electron beam, and the diffraction of the electromagnetic undulator are explicitly incorporated in the formalism. An oscillator experiment has also been considered. They

derive the solutions of the optical pulse evolution equation in the weak field, low gain, and long electron pulse regime. As an example, they apply the results to state-of-the-art electron beams and conclude that they would not satisfy the requirements to operate a free-electron laser in a self-amplified spontaneous emission regime. On the other hand, preliminary results for the oscillator experiment suggest that moderate improvements in the quality of the electron beam and the CO/sub 2/ laser energy would make it feasible to obtain sufficient small-signal gain to overcome the expected mirror losses in the 10-50 nm range of wavelengths.

6272 **An optical switch.** Christophorou, L.G.; Hunter, S.R. (to to Dept. of Energy). US Patent Application 6-044,178. 30 Apr 1987. 13p. Contract AC05-84OR21400. DE89000215 NTIS, PC A03/MF A01 - OSTI. Order Number DE89000215/JAW.

The invention is a gas mixture for a diffuse discharge switch having an electron attaching gas wherein electron attachment is brought about by indirect excitation of molecules to long live states by exposure to laser light. 3 figs.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 5744, 5984, 6141

6273 **(JAERI-M—88-145) Numerical programs of heat conduction problem using a personal computer. Comparison of various numerical schemes.** Kunugi, Tomoaki. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 49p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755522/JAW.

This paper describes the numerical procedures of steady and unsteady heat conduction problems using a personal computer. In this paper, eight numerical schemes for the one-dimensional unsteady heat conduction equation are discussed, and their results are compared with the analytical solutions. Consequently, it is found that the multipoint Adams-Bashforth method is the best scheme. Moreover, two-dimensional steady and unsteady heat conduction problems are solved by various numerical schemes, and their computational time and results are compared with each other. Thirteen numerical analysis programs and a subroutine to draw contour lines for their results are written by the BASIC language and all programs are listed in this paper.

6274 **(PSI—17) Analytical models for the rewetting of hot surfaces.** Olek, S. (Paul Scherrer Institut, Wuerenlingen (Switzerland)). (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Oct 1988. 57p. NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88704972/JAW.

Some aspects concerning analytical models for the rewetting of hot surface are discussed. These include the problems with applying various forms of boundary conditions, compatibility of boundary conditions with the physics of the rewetting problems, recent analytical models, the use of the separation of variables method versus the Wiener-Hopf technique, and the use of transformations. The report includes an updated list of rewetting models as well as benchmark solutions in tabular form for several models. It should be emphasized that this report is not meant to cover the topic of rewetting models. It merely discusses some points which are less commonly referred to in the literature. 93 refs., 3 figs., 22 tabs.

6275 **(SAND—88-1540C) Evaluation of PNS-computed heating and hypersonic shock tunnel data on sharp and inclined blunt cones.** Hudson, M.L. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 18p. (CONF-890123—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE88017119/JAW.

From 27. AIAA aerospace sciences meeting; Reno, NV, USA (9 Jan 1989).

As part of the ongoing development and verification of the Parabolized Navier-Stokes (PNS) technique, computed heat transfer rates have been compared with recently acquired experimental data. The flow fields were computer for laminar and turbulent flow over sharp, blunt tripped sphere-cones at 0{degree} to 20{degree} angle of attack in a hypersonic shock tunnel flow at Mach numbers of 11, 13, and 16. Grid refinement studies were performed and minimum smoothing parameters were sought. The average percent difference between the measured mean heat transfer rate and the PNS-computed value was 12% for the sharp and blunt cones at 0{degree} angle of attack. For the blunt cones at angle of attack, the average percent difference was 11% on the windward ray and 36% on the leeward ray. PNS-predicted flow physics such as boundary layer thickness, shock standoff distance, and crossflow separation were examined. 15 refs., 12 figs.

4205 Materials Testing

REFER ALSO TO CITATION(S) 5920, 6299

6276 **(BMHT—8710) Development of high resolution ultrasonic transducers for nondestructive evaluation. Phase 1. Final report.** (B.M.Hi-Tech, Inc., Collingwood, Ontario (Canada)). 1987. 94p. (MICROLOG—88-01566). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Development of advanced ceramic materials for use such as structural components in gas turbines and diesel engines depends on assuring that various mechanical and physical qualities are adequate. Nondestructive testing is thus necessary to ensure the absence of subsurface flaws. Ultrasonic testing is the favored method, as it enables detection and characterization of the very small critical flaws sizes typical of ceramics. Ultrasonic transducers used in such testing must be able to detect sound in the 50-150 MHz range, where attentuation losses are high. Development of the low-loss piezoelectric sensors is therefore necessary. This paper describes research to develop a material having a low dielectric constant and a high piezoelectric coupling coefficient. Efforts were concentrated on reviewing and developing materials for the thin-plate technique of transducer construction, and the essential properties required of such materials are outlined. The lead metaniobate family of ceramics, having a perovskite crystal structure, was found to have the most favorable properties. Thirty compositions were investigated and tested, and characterized as to their performance. Phased transducer arrays were examined as an alternative means of focusing ultrasonic transducers and of varying the acoustic beam angle. These arrays were found to have the advantages good resolution, good signal to noise ratio and acoustic beam steering capability. However, to realize their potential, it is necessary to eliminate conditions of constructive interference. 39 refs., 22 figs. 4 tabs.

6277 **(CEA-CONF—9466) Qualification of a digital radiographic equipment for thin weld inspection.** Boulanger, G.; Furlan, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Apr 1988. 16p. (In French). (CONF-8804225—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755452/JAW.

From APEND national meeting on realization and prospects in NDT; Aix-en-Provence, France (27 Apr 1988).

The level of quality asked for welding plugs to fuel pins requires to test all the welds, that is to say about 200 000 welds of the fuel assemblies of the fast reactor Super-Phenix. X-ray radiography is one of the tests. Before the operation was done on a film by the personnel automatic selection of tested material and image processing are substituted to the film in the digital radiographic equipment IRENE. Main advantages are: elimination of human factor in defect appreciation, reliability of image processing and instant availability. On 1000 welds a good correlation is obtained between results on films and those of image processing.

6278 **(EMR/MS—MSL87-153(TR)) Recommissioning of bentonite test equipment.** Wang, S.S.B.; Prud'homme, P.J.H. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mineral Sciences Lab.). 1987. 14p. (MICROLOG—88-02657). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Three bentonite samples were used to test existing instruments and previously established procedures for evaluating bentonite as drilling mud. The instruments tested were the Fann V-G viscosimeter and a Magcobar filter press. Bentonite properties measured included moisture, residue (sand content), colloidal content, swelling, viscosity and gel strength, and filtration. Only one bentonite sample, a high grade sodium bentonite, met all the American Petroleum Institute specification requirements for oil-well drilling fluid materials. 2 refs., 2 figs., 1 tab.

6279 **(EMR/MTL—MPRL87-1(TR)) Calibration of the ac potential drop technique for sizing of fatigue cracks in welded joints.** Vosikovsky, O.; Chaar, M.; Bouchard, R. (Canada Centre of Mineral and Energy Technology, Ottawa, Ontario. Metals Technology Labs.). 1987. 21p. (MICROLOG—88-02158). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The ac potential drop (ACPD) technique is being used in a project investigating materials for offshore structures, to monitor the growth of fatigue cracks in welded plate T-joints. In corrosion fatigue testing, beach marking techniques for monitoring the shape and size of growing cracks cannot be used. Instead, a computerized multiprobe ACPD calibration procedure based on empirical crack shape correction factors derived from measurements made in air was developed. The procedure is described in this report. The calibration is designed to monitor the maximum depth of the largest fatigue crack initiated from the weld toe. Particular attention is paid to sizing the many initial cracks because their growth and coalescence constitute a major part of the fatigue life, and are little understood. Calibrated maximum crack depths were compared with those measured from beach marks for a wide range of plate thickness and stress ranges. 3 refs., 11 figs.

6280 **(FEI—1827) Methods of mechanical materials testing in the BR-10 nuclear reactor. Technique of pre-reactor metrological tests of in-pile breaking devices.** Bul'kanov, M.G.; Kruglov, A.S.; Pevchikh, Yu.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704437/JAW.

Nonstandard intrachannel test devices (ITD) are used to investigate radiation creep of structural materials in the BR-10 reactor. ITD differs from standard test devices by essentially lowed hardness of power-transmitting circuit elements and temperature instability of practically all device unit. In this connection the suggested technique of pre-reactor metrological tests of ITD acquires special importance. By means of special mechanisms and automatized system the calibration of strain gages is conducted, and ITD hardness ratio is determined. Concrete examples of realization of the technique described as applied to ITD of IPR-200 and IPC-0.15 types are considered. 6 refs.; 3 figs.

6281 **(IAEA-TECDOC—462) Ultrasonic testing of materials at level 2. Training manual for non-destructive testing techniques.** (International Atomic Energy Agency, Vienna (Austria)). Jun 1988. 283p. NTIS (US Sales Only), PC A13/MF A01. Order Number DE88704482/JAW.

Ultrasonic inspection is a nondestructive method in which high frequency sound waves are introduced into the material being inspected. Ultrasonic testing has a superior penetrating power to radiography and can detect flaws deep in the test specimen (say up to about 6 to 7 meters of steel). It is quite sensitive to small flaws and allows the precise determination of the location and size of the flaws. Basic ultrasonic test methods such as the through transmission method and the resonance method, sensors and testing techniques are described. Pulse echo type flaw detectors and their applications for inspection of welds are surveyed. Ultrasonic standards, calibration of the equipment and evaluation methods are presented. Examples of practical applications in welding, casting and forging processes are given. Figs and tabs.

6282 (INIS-SU—61/A, pp 3-5) **Development of methods and means of fuel element quality assurance.** Shtan', A.S. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical radiation.

Requirements to the complex of commercial means of nondestructive testing for fuel element quality assurance are considered. The main results of the carried out research works as well as the problems and prospects of development of nondestructive testing are pointed out. 8 refs.

6283 (INIS-SU—61/A, pp 11-13) **Combined post of nondestructive testing geometrical dimensions and column mass of fuel pellets.** Bazin, V.A.; Bulgakov, G.G.; Egolin, Ya.G. and others. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

The problems concerning development of the combined post of nondestructive testing geometrical dimensions and column mass of fuel pellets are considered. Accuracy parameters of the facility are presented. Special attention is paid to principles of constructing the facility and its main parts. Structurally the complex comprises a processing and detecting module and a transport-operating module. The optical-electron method (using IR radiation) was chosen for measuring geometrical dimensions. The principle of mass measuring presupposes transformation of pellet mass into a frequency signal by means of the vibrofrequency detector of the weighing device. 2 figs.

6284 (INIS-SU—61/A, pp 6-8) **Formation of module base of unit complex of means for nuclear fuel element quality control.** Afanas'ev, V.N.; Bespyatykh, A.S.; Siletskaya, M.A.; Kalmykov, V.I.; Inikhova, T.I.; Anoshina, N.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Methodical problems of formation of module base of a unit complex of means for nuclear fuel element quality assurance using the method of design arrangement are considered. Formation is realized by the method of sequential decomposition of functions of complex testing means up to the level of simplest functions, each of them being realized by the basis module (BM) of a functional group. The totality of BM functional groups specifies the structure of the module basis. Each of the functional groups includes BM with different parameters and/or characteristics, the optimization of which permits to determine the composition of the module basis. BM can be borrowed from the State system of automated devices and means or may be developed within the frames of the complex. 3 refs.; 2 figs.

6285 (INIS-SU—61/A, pp 13-16) **Flow and density testing ceramic nuclear fuel by an acoustic method.** Gevondyan, V.T.; Kochetov, M.A.; Suchkov, G.A.; Shchavelin, V.M.; Marakueva, N.A.; Klyunina, N.M. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Some problems of development and application of the acoustic method for nuclear fuel pellet quality assurance and testing the technology of their fabrication are considered. Dependences of frequences of intrinsic mechanical oscillations of pellets on their geometrical sizes are determined. A nomogram is developed for calculation of the specimen spectra of pellets. The method of hydrostatic

weighing in mercury and the acoustic method are stated to have practically the same accuracy of density determination, while the accuracy of the method of hydrostatic weighing in water is more than three times less. It is shown that the acoustic method permits to exercise quality assurance fuel pellets by flaw and density testing, and at the corresponding arrangement of the control only the imaginary density at the relativistic error of 0.4%. 10 refs.; 3 figs.; 2 tabs.

6286 (INIS-SU—61/A, pp 21-23) **Equipment for automatic testing fuel pellet density and geometry sizes.** Gevondyan, V.T.; Kochetov, M.A.; Molodtsov, K.I.; Suchkov, G.A.; Shchavelin, V.M. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

A set of ultrasound spectroscopic equipment for automatic testing fuel pellet density and presence of detectors is described. 1 fig.

6287 (INIS-SU—61/A, pp 29-33) **Determination of signal-to-noise ratio for optical electronic probe to find flows at fuel cladding surface.** Nikitenko, N.F. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

The problem of estimation of signal-to-noise ratio of a reflectometric detector for mixed, mirror-diffusion light reflection from rough surface of the fuel cladding is solved. The estimation technique is based on analytical description of the reflection by means of scattering cross section and on account of random shifts of the cladding axis relatively to the detector axis during testing. 2 refs.; 4 figs.

6288 (INIS-SU—61/A, pp 33-34) **Optical-digital systems for testing geometric dimensions of long fuel claddings.** Bogomolov, E.N.; Zenkova, D.F.; Karlov, Yu.K. and others. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

The principle of operation of the LDI-1M laser diffractometer for testing geometric dimensions of long cylindrical tubes is described. Its utilization permits to increase testing efficiency and to control technological processes for sustaining the assigned diameter. 1 fig.

6289 (INIS-SU—61/A, pp 35-40) **Combined optical-electromagnetic scanner to find flows at fuel element surfaces.** Nikitenko, N.F.; Kuksa, N.N.; Shmal', A.L.; Vinichenko, P.G. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

A flaw detector containing two pairs of rotating converters: eddy current to discover mechanical flaws of more than 50 μm depth and photoelectric ones to discover colored defects of "white corrosion spot" type has been developed. Structurally the converters are mounted in a scanning head rotating around a tested fuel element at the rate of 3600 rev./min. Description of the flowsheet of the flaw detector, schemes and characteristics of the eddy current and photoelectric converters, obtained on specimens with artificial flaws as well as test results of the flaw detector on real models of applicable and defective fuel elements are presented. 4 refs.; 8 figs.

6290 (INIS-SU—61/A, pp 40-42) **Testing external surface of fuel element tubes for power nuclear reactors.** Naugol'nykh, O.G.; Nelyubin, Yu.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Optical methods are regarded perspective for discovery and detection of flaws of external surfaces of fuel element tubes. The TV method has highest information content among them. Two mock-ups of facilities based on the TV method using a "dissector" type TV device and a TV tube with charge accumulation (vidikon) have been developed. It is concluded that complex testing - combination of ultrasonic, photoelectric and TV methods in a facility is necessary for discovery and analysis of the whole variety of flaws, though sensitivity of the TV method is enough for disclosure of all the main defects. 2 refs.

6291 (INIS-SU—61/A, pp 42-44) **Penetration depth testing the fuel element cladding and end element joint by eddy currents.** Vyakhorev, V.G.; Tsvetkova, S.I. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Advantage of the eddy method of testing the fuel cladding penetration depth as compared with ultrasonic and X-ray ones presupposes increase of sensitivity to low penetration and an opportunity of testing the penetration near the edge. Increase of the sensitivity is attained by means of an aerostatic bearing, on the working edge of which induction coils are dislocated, and increase of edge effect- by means of a superposed differential converter with sector windings, the adjacent linearly stretched sections of which are located at the right angle. At the diameter of the converter of 12 mm, nozzle chamber diameter of 5 mm, diffuser diameter of 7 mm the measuring range of the penetration depth makes up 0-1.1 mm. 5 refs.; 6 figs.

6292 (INIS-SU—61/A, pp 45-46) **Automation of testing the metrological reliability of nondestructive control systems.** Zhukov, Yu.A.; Isakov, V.B.; Karlov, Yu.K.; Kovalevskij, Yu.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Opportunities of microcomputers are used to solve the problem of testing control-measuring systems. Besides the main program the program of data processing when characterizing the nondestructive control systems is written in the microcomputer. The program includes two modules. The first module contains tests-programs, by which accuracy of functional elements of the microcomputer and interface elements with issuing a message to the operator on readiness of the elements for operation and failure of a certain element are determined. The second module includes: calculational programs when determining metrological reliability of measuring channel reliability, a calculational subprogram for random statistical measuring error, time instability and "dead time". Automation of testing metrological reliability of the nondestructive control systems increases reliability of determining metrological parameters and reduces time of system testing. 1 fig.

6293 (INIS-SU—61/A, pp 51-54) **Means of metrological support of facilities for nondestructive testing fuel distribution in reference fuel elements.** Ivanov, V.B.; Gadzhiev, G.I.; Inchagov, A.V. and others. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

References of fuel density and plutonium content in it representing a measure of plutonium density and content and consisting of several sections are developed, fabricated and tested for testing the facilities and techniques of nondestructive control of fuel element quality with single-component and mixed fuel for fast reactors. Fuel mass (for mixed fuel-plutonium mass), its average density, the inner diameter of the cladding and length of the fuel column are normalized metrological characteristics at the section of density references (DR). DR are produced for 7-9 g/cm/sup 2/ density range and 4-16 g plutonium content range. The relative error of fuel mass determination does not exceed +-0.15%, fuel density- +-0.83%. 4 refs.; 1 fig.; 1 tab.

6294 (INIS-SU—61/A, pp 54-57) **Metrological investigations into the technique for determining fuel density and plutonium mass using AKORT-2 installation.** Inchagov, A.V.; Leshchenko, Yu.I.; Semenov, A.L. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Metrological characteristics of AKORT-2 facility using the gamma-absorption method for density measuring and the method of plutonium intrinsic γ-radiation detection are investigated using standard models of the plant. At the efficiency of the facility equal to 5 fuel el./h the relative random component of the error in determination of fuel density and plutonium mass at the section of a 10 mm long fuel element does not exceed +-0.5 and +-2.5% respectively (confident probability 0.95%), and the relative value of their systematic error makes up +-1 and +-3.7%. 3 refs.; 3 figs.; 2 tabs.

6295 (INIS-SU—61/A, pp 57-60) **Results of metrologic study on the support of eddy current flow detector operation.** Ivanov, V.B.; Inchagov, A.V.; Kucherov, A.N.; Leshchinskij, A.G.; Prokudanova, G.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Specimens of fuel element cladding with artificial flaws used for adjustment and testing the eddy current flaw detector are investigated. Mechanical flaws were superposed on the cladding by means of a drill (through holes) and a cutting tool in a special instrument (transverse annular and longitudinal marks). Laser flaws were superposed by means of KVANT-12 facility. Sensitivity of the eddy current flaw detector to defects is investigated. The dependence of the flaw detector response on the diameter of the through hole is stated to have linear character. Estimation of the eddy current flaw detector detection threshold to mechanical defects makes up: for marks- length-20 μm, for through holes- diameter-0.25 mm. It is suggested that traces obtained from the effect of a laser beam on the fuel cladding should be used as an artificial flaw. Reproduction of laser flaws at the given stage of studies makes up 15%. Specimens of flaws produced for adjustment of operating modes and testing the eddy current flaw detector are fabricated. 4 figs.; 1 tab.

6296 (INIS-SU—61/A, pp 60-62) **State graph technique to estimate reliability of nondestructive testing stations.** Gorchakova, E.E.; Emel'yanov, S.S.; Kabakova, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

The technique for calculation of reliability of nondestructive testing stations (NTS) at the stage of the design based on consideration of the random process of the system transition from one state to another associated with failures of the NTS units and modules at random time moments is suggested. The process of plotting the phase diagram for a typical NTS structure as well as the systems of differential and linear equations of state probabilities is described. Solution of these equations by the developed computerized program permits to calculate the probability of faultless operation, coefficient of readiness as well as mean operation time up to NTS failure. Dependences of mean operation time up to NTS failure for different schemes of redundancy and time of redundant unit reproduction are shown. 2 refs.; 2 figs.; 1 tab.

6297 (INIS-SU—61/A, pp 62-64) **Software reliability estimation for local systems of nondestructive testing.** Kopytov, V.V.; Solodkin, L.T.; Fedorov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

Techniques for quantitative estimation of the probability of faultless operation of software (S) developed for local systems of fuel element nondestructive testing are suggested. One or several techniques for calculation of errors remaining in the program, failure frequency and probability of faultless operation of the program may be used at different stages of software operation cycle. An example of calculating some reliability parameters of the software is given. 4 refs.; 3 tabs.

6298 (INIS-SU—61/A, pp 67-69) **Operation of the UKK-2 facility for tube complex testing and way of its further improvement.** Ogarkov, N.V.; Senyutkin, P.A.; Silaev, A.N.; Topychkanov, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780031/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 1(34).
In Radiation technique. Scientific-technical collection.

The UKK-2 ultrasonic 8-channel facility for complex control is designed for control of continuity, wall thickness of 0.3-1.0 mm, inner diameter of tubes and external diameter of 7-15 mm. Utilization of UKK-2 increased reliability of control, stabilized tube quality at a higher level, increased control efficiency 2-3 times. The most noticeable shortcomings of the UKK-2 are as follows: impossibility of differential separation of tubes rejected by sizes, by rectifiable and nonrectifiable rejects as well as absence of devices for mechanized loading, unloading and grading the tubes. The flowsheet, design and technological shortcomings of the facility are discovered during its operation. Ways of further improvement of the facility are as follows: development of the system for control result analysis on the basis of a microcomputer, equipment with devices for loading, unloading and grading the tubes; development of more reliable electron devices and units, means of automated diagnostics and automated tuning, increase of the level of metrological provision, improvement of hardware and software of the facility.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 6035, 6197, 6199, 6389, 6400

6299 **(LA—11346-PR) Milliwatt Generator Project: Progress report, April 1984--March 1986.** Rinehart, G.H.; Latimer, T.W. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 30p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004142/JAW.

This report covers progress on the Milliwatt Generator Project from April 1984 through March 1986. Activities included fuel processing and characterization, production of heat sources, fabrication of pressure-burst test units, compatibility studies, impact testing, and examination of surveillance units. 3 refs., 24 figs., 13 tabs.

6300 **(MLM—3541) Applications of numerical stress wave studies to explosively driven ferroelectric power supplies.** Chou, T.S. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 6 Sep 1988. Contract AC04-76DP00053. 50p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002533/JAW.

A series of numerical modelings of an explosively driven ferroelectric power supply was performed. The modelings were based on a standard configuration of an explosively driven power supply. When subjected to a planar compression wave traversing lengthwise, the ferroelectric elements of the power supply release a high current of electrical energy. This release must occur before the rarefaction wave arrives to destroy the elements. The modelings performed proved the feasibility of various modifications to the power supply. 5 refs., 36 figs.

6301 **(SAND—88-1509) Design information for the 4/3 SNOS test chip TA716.** Green, J.M. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1988. Contract AC04-76DP00789. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002996/JAW.

The TA716 is a 4/3 SNOS test chip, and a redesign of the SA2999 test chip. This redesign was for the purpose of adding large area capacitors to address the gate oxide rupture problem. Modules 1, 2, 3, 6, 9, and 13 from the old test chip were retained and relocated to the upper middle section of the TA716. The remaining modules were deleted and additional test structures were added. This increased the size of the test chip to 244 {times} 227. 13 figs.

6302 **(SAND—88-2889) Minutes of the Lightning Arrestor Connector (LAC) Program Review meeting June 8, 1988.** Smith, E.L. (comp.). (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 94p. (CONF-8806275—Summ.). NTIS, PC A05 - OSTI. Order Number DE89003727/JAW.

From Lightning Arrestor Connector (LAC) program review meeting; Albuquerque, NM, USA (8 Jun 1988).

This report documents the June 8, 1988, meeting of the Lightning Arrestor Connector Program Review held at Sandia National Laboratories in Albuquerque, New Mexico.

6303 **(SAND—88-3035C) The role of vacuum bakeout and uv-ozone cleaning in the sealing of IC packages.** Garrett, S.E. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 4p. (CONF-8810159—3). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003237/JAW.

From 3. inter-agency cleaning and contamination control seminar; Kansas City, MO, USA (18 Oct 1988).

Low production yields were being experienced at an integrated circuit packaging lab operated jointly by the Allied-Signal Albuquerque Microelectronic Operation and the Packaging Technology Division of Sandia National Laboratories. It was suspected that organic contamination of the sealing surfaces was causing the low yields. These low yields were not only undesirable, but also raised questions about the quality of the parts that did pass the yield tests. The reliability of these parts was therefore questionable and efforts were taken to improve both the yield and the quality of the hermetic sealing operation.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 5800, 5801, 5854, 5855, 5958, 6147

4230 Marine Engineering

REFER ALSO TO CITATION(S) 6395

6304 **(EMR/ER—8410) Assessment of non-destructive technology required for inspecting offshore structures.** Mak, D.K. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). 1984. 153p. (MICROLOG—88-04575). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This report contains a critical review and assessment of the methods used for non-destructive evaluation (NDE) of offshore structures. The capabilities of Canadian and foreign organizations to perform offshore inspection are also evaluated. The report also reviews NDE equipment together with their specifications and manufacturing. Experience has shown that the main defects encountered in inspection are cracks and corrosion, and methods currently used in the type of inspection most critical for meeting the principal objectives of NDE are: close visual inspection by divers; radiography; ultrasonic testing; and magnetic particle inspection. NDE methods based on ultrasonics have been found in general to be suitable for underwater use and recommended for the examinations of internal defects and wall-thickness measurements where the velocity of sound propagation through the material under examination is known. Various methods based on the principles of electromagnetism have also proved useful in the underwater detection of surface defects. The survey shows that the common practice in equipment development is the modification of what has been successfully used above water to make it operational underwater. The review of NDE techniques under development indicates that emphasis will increasingly be on automation and remote control of equipment, as well as on real-time signal processing and the optimization of the operations involved in offshore NDE. Instrumented monitoring of offshore structures is also discussed, and recommendations are made for transfer of NDE technology to Canada. 137 refs., 31 figs., 11 tabs.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 5782, 5964

4250 Power Cycles

REFER ALSO TO CITATION(S) 6395

43 PARTICLE ACCELERATORS

6305 **(CERN-EP—88-130) The future in high-energy physics.** Rubbia, C. (European Organization for Nuclear Research, Geneva (Switzerland)). 5 Oct 1988. 10p. (CONF-880695—69). NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89003186/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

This paper discusses the future applications of colliding accelerators. Topics covered are: the immediate future, LEP1; LEP at a Z{degree} factory; the road towards LEP200; the importance of ep collisions; hunting for the Higgs: a test case for future colliders; higher-energy e^+e/sup {minus}/ collisions; intermediate energy e^+e/sup {minus}/ collider; and the ultimate e^+e/sup {minus}/ collider. 15 refs., 4 tabs. (LSP)

4301 Design, Development, And Operation

6306 **(BNL—42058) AGS II.** Lee, Y.Y.; Lowenstein, D.I. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 2p. (CONF-8806243—4). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003574/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

At present, the AGS slow extracted beam current is 1 μA. With the completion of the Booster in 1990 and the associated AGS modifications, the current will rise to 4--5 μA. With the subsequent addition of the Stretcher, which is under design, the current will rise to 8--10 μA and approximately 100% duty factor. We are now examining the possibility of a further enhancement to a current level of 40--50 μA CW.

6307 **(CONF-880695—70) Achromatic lattice comparison for light sources.** Kramer, S.L.; Crosbie, E.A.; Cho, Y. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 3p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003937/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

The next generation of synchrotron light sources are being designed to support a large number of undulators and require long dispersion-free insertion regions. With less demand for radiation from the dipole magnets, the storage ring cost per undulator beam can be reduced by decreasing the number of dipole magnets and increasing the number of dispersion free straight sections. The two simplest achromatic lattices are the Chasman-Green or double-bend achromatic (DBA) and the three-bend achromat (TBA). The DBA in its simplest form consists of a single horizontally-focussing quadrupole between the two dipole magnets. Since this quadrupole strength is fixed by the achromatic condition, the natural emittance ({var←epsilon}{sub n}) may vary as the beta functions in the insertion region (IR) are varied. The expanded Chasman-Green (also DBA) uses multiple quadrupoles in the dispersive section to provide emittance control independent of the beta functions in the IR. Although this provides flexibility in the ID beta functions, the horizontal phase advance is constrained to {phi} {approx←equal} 180{degree} between approximately the centers of the dipole magnets. If small {var←epsilon}{sub n} is required, the horizontal phase advance between the dipoles will be near one and the lattice properties will be dominated by this systematic resonance. The TBA lattice places a third dipole between the DBA dipoles, eliminating the 180{degree} horizontal phase advance constraint. However, the requirement of small {var←epsilon}{sub n} limits the

range of tune, since {mu}{sub x} {approx←equal} 1.29 in the dipoles alone for {var←epsilon}{sub n} near its minimum value. The minimum emittance is five times smaller for the TBA than for the DBA with the same number of periods and, therefore, its phase advance can be relaxed more than the DBA for the same natural emittance. 5 refs., 4 figs., 1 tab.

6308 **(DOE/EIS—0138-Vol.2-A.3) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment/response document: A, Comments: 3, Letters postmarked after 10/17/88.** (USDOE, Washington, DC). Dec 1988. 175p. NTIS, PC A08 - OSTI. Order Number DE89004231/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6309 **(DOE/EIS—0138-Vol.2-Summ.) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment/response document: Summary and index.** (USDOE, Washington, DC). Dec 1988. 419p. NTIS, PC A18 - OSTI. Order Number DE89004219/JAW.

This volume is divided into five parts as follows: Summary and Index; Letters submitted by commenters in response to the Draft Environmental Impact Statement (DEIS) from date of issue through October 17, 1988; Transcripts of testimony at the public hearings conducted by the DOE in the vicinity of each site alternative; Letters postmarked after October 17, 1988; and Comment responses to both the letters and the testimony. This summary and index is published as a guide to the reader in reviewing this document. The summary is of the approximately 7000 comments received by the DOE from a total of about 5700 commenters. It was prepared as a general reference and guide to the readers of this volume. The Index follows the summary. The first index is an alphabetical listing of commenters (of both letters and transcripts) and indicates the number each commenter was assigned. The commenter numbers guide the reader to DOE comment responses in Volume 2B which are in numerical order.

6310 **(DOE/EIS—0138-Vol.3) Superconducting Super Collider: Final environmental impact statement: Volume 3.** (USDOE, Washington, DC). Dec 1988. 113p. NTIS, PC A07/MF A01 - OSTI. Order Number TI89004235/JAW.

This report is an environmental impact statement on the Superconducting Super Collider. It discusses the methodology for site selection. Contained in this paper are the invitation for site proposals; the establishment of the best qualified list; the identification of preferred final site; and the selection of the preferred site for the SSC. (LSP)

6311 **(FNAL-TM—1541) Design study of a medical proton linac for neutron therapy.** Machida, S.; Raparia, D. (Fermi National Accelerator Lab., Batavia, IL (USA); Texas Accelerator Center, The Woodlands). 26 Aug 1988. Contract AC06-76RL01830. 66p. (CONF-881049—8; CONF-881151—7). NTIS, PC A04 - OSTI. Order Number DE89000412/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

This paper describes a design study which establishes the physical parameters of the low energy beam transport, radiofrequency quadrupole, and linac, using computer programs available at Fermilab. Beam dynamics studies verify that the desired beam parameters can be achieved. The machine described here meets the aforementioned requirements and can be built using existing technology. Also discussed are other technically feasible options which could be attractive to clinicians, though they would complicate the design of the machine and increase construction costs. One of these options would allow the machine to deliver 2.3 MeV protons to produce epithermal neutrons for treating brain tumors. A second option would provide 15 MeV protons for isotope production. 21 refs., 33 figs.

6312 (INIS-BR—1334, pp 269-290) **Radiation in installations. Shielding.** Pereira Junior, P.P. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704793/JAW. (CONF-8805225—).

From 1. meeting on medical physics; Rio de Janeiro, Brazil (23 May 1988).

An example of the radioprotection and shield room projects for a linear accelerator are shown. The main characteristics, the description of the installation and the condition of operation are described. A list with the thickness for each area is also described. (C.G.C.).

6313 (INIS-BR—1334, pp 289-294) **Radiometric survey in mega-volt installators.** Pereira Junior, P.P. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704793/JAW. (CONF-8805225—).

From 1. meeting on medical physics; Rio de Janeiro, Brazil (23 May 1988).

The radiometric survey for linear accelerator room is shown. The description of the installation and the condition of operation are described. A list with the radiation dose for each area is also presented. (C.G.C.).

6314 (JINR-D—9-87-105-Vol.2, pp 113-116) **Status on construction of the IYaF SO AN SSSR racetrack microtron.** Akimov, V.E.; Vecheslavova, T.E.; Vinokurov, N.A. and others. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Works on construction of a 30 MeV racetrack microtron are conducted in the Institute for Nuclear Physics of the Siberian department of the USSR Academy of Sciences. The microtron comprises an injector, two 180-degree main bending magnets, a straight-line space common for particles with different energies, where an accelerating RF-structure, inlet magnets and a quadrupole lens are installed and nine separate straight-line spaces. An accelerating structure is a chain of nine resonators connected with the common coaxial resonator. Magnicon-a new SHF generator with a circular electron beam sweep-serves as the source of HF power for the microtron. A gun with LaB/sub 6/ cathode serves as an electron source. A new SHF generator-magnicon-and microtron injector are currently produced and teseted. All basic microtron units are produced as well and assembling and preparation for the whole microtron startup has started. 4 refs.; 2 figs.

6315 (JINR-D—9-87-105-Vol.2, pp 117-120) **Results of investigations of small-sized sealed ion diodes with magnetic insulation and transparent inner anode for generation of pulse neutron fields.** Vojtenko, V.A.; Gul'ko, V.M.; Kolomiets, N.F. and others. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Two variants of realizing a magnetic insulation neutron tube are described. The first variant applies a three-electrode vacuum-acr deutron source and the second-a laser one. As a result of the testings conducted a flux into a complete solid angle exceeding 10/ sup 9/ neutron/s under 5 Hz frequency and vsub 0/≃30 kV, which corresponds to the accelerated deutron current amplitude ≃ A is produced. 5 refs.; 3 figs.

6316 (JINR-D—9-87-105-Vol.2, pp 121-123) **Polyorbital induction accelerators.** Zvontsov, A.A.; Kas'yanov, V.A.; Romanova, V.A.; Chakhlov, V.L. (Tomskij Politekhnicheskij Inst. (USSR). Nauchno-Issledovatel'skij Inst. Ehlektronoj Introskopii). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

To obtain a greater number of accelerated particles per cycle dynamics of electrons accelerated in a betatron along several equilibrium orbits located in the same emitter unit is considered. Magnetic field behaviour in such a polyorbital betatron is analytically studied. Magnetic fields can be formed by a system of current conductors or by a combination of ferromagnetic material and coils. In this case a part of ferromagnetic material located near the accelerator face parts can serve as a magnetic "mirror". 5 refs.

6317 (JINR-D—9-87-105-Vol.2, pp 127-130) **Prospects of application of electron accelerators for purification of industrial plants gaseous wastes.** Glukhikh, V.A.; Ivanov, A.S.; Svin'in, M.P.; Fedotov, M.T.; Vojnalovich, S.A. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Description of an industrial plant for purification of industrial gaseous wastes is presented. The plant comprises a chamber and four electron accelerators with o.75 MeV energy each, directed towards each other. Electrons are accelerated in the accelerating system, then the electron beam is scanned in two directions by a scanning device and extracted from the accelerator vacuum chamber through a metallic membrane. The extracted beam has 100x3000 mm dimensions. The accelerating structure and the eletron source are located inside the metallic vessel, filled with an insulating gaseous mixture. Radiators are connected with a common high-voltage generator by cables with grounded coating. The high-voltage generator is a step-up transformer with a sectional secondary winding and built-in rectifying elements. The cost of 1000 m/sup 3/ gaseous mixture purification will make up 35.5 cop. 4 refs.; 3 figs.

6318 (JINR-D—9-87-105-Vol.2, pp 131-135) **Status and prospects of development of neutron generators in the Efremov's NIIEhFA.** Voronin, G.G.; Ivanov, A.S.; Latmanizova, G.M.; Svin'in, M.P.; Tarvid, G.V.; Fedotov, M.T. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

The status of accelerator development for neutron generators conducted in the Efremov's NIIEhFA is presented. Development of an accelerator for a neutron generator with (1-2)x10/sup 11/ neutr/s efficiency is completed. The accelerator is designed for producing deuterium atomic ion beam with the current of up to 2 mA and 150 keV energy on the generator target. An accelerating tube with duoplasmatron type ion source is installed in a vessel filled with an insulating gas at 0.7 atm. pressure. Neutron generator prototypes with the efficiency of about 10/sup 12/ neutr./s are produced and put into operation. The accelerator provides for production of a ion beam with 15 mA current at 150 MeV energy on the generator target. Further works in the field of construction of high-power neutron generators are directed to increasing the ion beam intensity, improving the accelerator parameter and performance stability. Works on improving the generator control systems are conducted. 6 refs.; 4 figs.

6319 (JINR-D—9-87-105-Vol.2, pp 136-140) **Prospects of using the R-7 (U-120 M) cyclotron ion beams for element analysis.** Belyanin, O.P.; Zavodchikov, V.M.; Komov, A.I. and others. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

The possibility to accelerate ions of different mass and energy at the R-7 (U-120M) accelerator allows one to develop nuclear-physical analysis methods based on the most probable process-elastic scattering. It is shown that the use of broad resonances is the most perspective for light element analysis goal application. Using these resonances it is possible not only to determine the light impurity integral content but its depth distribution as well. To optimize the analysis methods investigations into the method applicability energy range were conducted. It is found that the energy range E=18-22 MeV is the most optimal for analysis under investigation into samples with substrate mass numbers falling within 50-120 a.m.u. interval. 6 refs.; 5 figs.; 1 tab.

6320 (JINR-D—9-87-105-Vol.2, pp 147-150) **6-10 MeV small-sized betatron for intraoperational irradiation.** Kashkovskij, V.V.; Lisin, V.A.; Filimonov, A.A.; Chakhlov, V.L. (Tomskij Politekhnicheskij Inst. (USSR). Nauchno-Issledovatel'skij Inst. Ehlektronnoj Introskopii). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Description of a 10 MeV small-sized pulsed betatron with the dose rte in the center of the irradiated field making up 3 Gy/min, developed for intraoperational irradiation purposes is presented. The betatron comprises control panel, emitter and 191 kg current pulse generator. The betatron specifications and its investigation results are presented. 4 refs.; 2 figs.

6321 (JINR-D—9-87-105-Vol.2, pp 151-154) **Therapy complexes using electron linacs.** Vakhrushin, Yu.P.; Glukhikh, V.A.; Gusev, O.A. and others. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

To increase the therapy efficiency it is proposed to create a therapeutic complex, comprising 4-6 electron linacs, equipment for anatomotopometric survey and computer-base control system. A complex of 4-6 accelerators may service a region with the populaion of about 4 million people which assumes their location in large cities with the developed infrastructure of indusry, scientific and educational institutions. 1 ref.

6322 (JINR-D—9-87-105-Vol.2, pp 163-169) **Accelerators for medicine.** Gol'din, L.L.; Lomanov, M.F.; Khoroshkov, V.S.; Chuvilo, I.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Three main aspects of accelerator application in medicine are considered which include fabrication of radioactive farmaceuticals for radionuclide investigations, positron tomography and accelerator application for radiotherapy. It is shown that to fabricate the full number of radioisotopes necessary for medicine cyclotrons with the proton energy of the order of 50 MeV are needed. However, under the appropriate choice of reactions and targets it is possible to fabricate almost any farmaceutials at 20 MeV proton energy as well. Problems of corpuscular radiotherapy, such as patient irradiation with protons, neutrons, π/sup -/-mesons and heavy ions are considered. Necessity in creating a center equipped wih a cyclotron allowing one to generate neutrons with the energy of the order of 30 MeV and equipping this center with instruments for dose field formation and multifield irradiation is shown. 5 figs.

6323 (JINR-D—9-87-105-Vol.2, pp 170-173) **Characteristics of a standing wave accelerating structure for common-series medical electron linacs.** Kirillin, Yu.Yu.; Nikolaev, V.M.; Rybchinskij, V.M.; Smirnov, V.L.; Terent'ev, V.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Calculated and experimental RF-parameters of the accelerating structure of the LUEhR-40 linear electron accelerator designed for radiotherapy application are presented. A standing wave accelerating structure with a two-fold beam acceleration in opposite directions is used in the accelerator. The accelerating structure length makes up 1.6 m. At 2.5 MW SHF-power at the structure inlet and 20 keV electron injection energy the accelerated electron energy obtained made up 16.2 MeV at 20 μA current which agrees with the calculated values within the limits of measurement accuracy. Electron beam diameter after a one-turn acceleration did not exceed 2 mm. 4 refs.; 3 figs.; 1 tab.

6324 (JINR-D—9-87-105-Vol.2, pp 189-192) **Long-time confinement of electron rings in the JINR heavy-ion collective accelerator prototype.** Kuznetsov, I.V.; Perel'shtejn, Eh.A.; Razuvakin, V.N.; Sumbaev, A.P.; Timokhin, V.A.; Cheremukhin, A.E.; Shirkov, G.D. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Results of experiments on long-time confinement of electron rings in the JINR KUTI prototype are presented. Long-time confinement of electron rings is achieved by formation of magnetic field slowly dropping in time at the last compression stage when the current value in them is maximal. It is shown that the increase of ring lifetime at minor radii have taken place at the expence of energy losses for synchrotron radiation. The experimentss conducted have confirmed the possibility of the lon-time confinement and allowed one to investigate the basic ring parameters in slowly dropping magnetic field during the ring lifetimes at minor radii, exceeding sufficiently the compression time which allos one to expect the production of high charge degree of ions in the ring. 11 refs.; 8 figs.

6325 (JINR-D—9-87-105-Vol.2, pp 193-195) **LUEhK-20 linear induction electron-ring accelerator.** Aleksandrov, V.S.; Golubev, I.I.; Dolbilov, G.V. and others. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

The LUEhK-20 linear induction accelerator is a part of the KUTI-20 heavy ion collective accelerator and is designed for electron ring acceleration in the electric field. The LUEhK-20 comprises ten accelerating sections; ten modulators; a transitional section between preliminary acceleration gradient solenoid and the first accelerating section; nine intersection solenoids and a matching solenoid at the end of the last section. The length of the LUEhK-20 is 21.5 m. Description of particular LUEhK-20 systems is presented. Design is described and modulator circuit is presented. Inductor and intersection solenoid structures are demonstrated. Coil supply circuit is presented. Three modulators are currently arranged and put into operation. Full voltage produced at a single section is 2 MV. 5 refs.; 7 figs.

6326 (JINR-D—9-87-105-Vol.2, pp 224-227) **Experiments on H/sup -/ acceleration in the U-240 Kiev isochronous cyclotron.** Bezruk, A.I.; Bykov, V.I.; Linev, A.F.; Olejnik, E.E. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

The U-240 isochronous cyclotron is a perspective facility for /sup 123/I isotope production. Experiments on beam transport depending on the gas leaking from the source are conducted for the sake of successful solution of the problem of H/sup -/ ion acceleration and extraction from the source. Accelerating chamber efficiency depending on various parameters is presented. 5 refs.; 4 figs.

6327 (JINR-D—9-87-105-Vol.2, pp 228-232) **JINR phasotron. Results of adjustment.** Vasilenko, A.T.; Vorozhtsov, S.B.; Glazov, A.A. and others. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Results of the JINR phasotron adjustment aimed at increasing the beam intensity and beam extraction with a uniform intensity distribution in time are presented. Various phasotron operation modes are investigated to improve its particular systems. As a result of adjustment the phasotron internal beam intensity is brought up to 7μA, the accelerated beam is extracted from the accelerator chamber with efficiency exceeding 50%. Beam stretching providing for the extracted beam duration increase up to 85% of modulation period is put into operation. Physical experiments at the accelerator. 9 refs.; 6 figs.

6328 **(DOE/EIS—0138-Vol.2-A.1(1006-1503)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 500p. NTIS, PC A21 - OSTI. Order Number DE89004222/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6329 **(DOE/EIS—0138-Vol.2-A.1(2509-3007)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 501p. NTIS, PC A22 - OSTI. Order Number DE89004225/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6330 **(DOE/EIS—0138-Vol.2-A.2(321-688)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 2, Transcripts.** (USDOE, Washington, DC). Dec 1988. 370p. NTIS, PC A16 - OSTI. Order Number DE89004230/JAW.

This document provides comments letter, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements.

6331 **(DOE/EIS—0138-Vol.2-A.1(501-1005)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 506p. NTIS, PC A22 - OSTI. Order Number DE89004221/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FL)

6332 **(DOE/EIS—0138-Vol.2-A.2(1-320)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A. Comments: 2. Transcripts.** (USDOE, Washington, DC). Dec 1988. 320p. NTIS, PC A14/MF A01 - OSTI. Order Number DE89004229/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6333 **(DOE/EIS—0138-Vol.2-A.1(1504-2006)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 503p. NTIS, PC A22 - OSTI. Order Number DE89004223/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6334 **(DOE/EIS—0138-Vol.2-A.1(2007-2508)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 502p. NTIS, PC A22 - OSTI. Order Number DE89004224/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6335 **(DOE/EIS—0138-Vol.2-A.1(3513-3986)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 476p. NTIS, PC A21 - OSTI. Order Number DE89004227/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6336 **(DOE/EIS—0138-Vol.2-A.1(3987-4377)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 392p. NTIS, PC A17 - OSTI. Order Number DE89004228/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6337 **(DOE/EIS—0138-Vol.2-B-Pt.2) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment/response document: B, Response: Part 2.** (USDOE, Washington, DC). Dec 1988. 435p. NTIS, PC A19/MF A01 - OSTI. Order Number TI89004233/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6338 **(DOE/EIS—0138-Vol.2-A.1(1-500)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment resolution document: A, Comments: 1, Letters.** (USDOE, Washington, DC). Dec 1988. 501p. NTIS, PC A22 - OSTI. Order Number DE89004220/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6339 **(DOE/EIS—0138-Vol.2-A.1(3008-3512)) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comments resolution documents: A. Comments: 1. Letters.** (USDOE, Washington, DC). Dec 1988. 507p. NTIS, PC A22 - OSTI. Order Number DE89004226/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements.

6340 **(DOE/EIS—0138-Vol.2-B-Pt.1) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment/response document: B, Response: Part 1.** (USDOE, Washington, DC). Dec 1988. 338p. NTIS, PC A15 - OSTI. Order Number DE89004232/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

6341 **(DOE/EIS—0138-Vol.2-B-Pt.3) Superconducting Super Collider: Final environmental impact statement: Volume 2, Comment/response document: B, Response: Part 3.** (USDOE, Washington, DC). Dec 1988. 458p. NTIS, PC A20 - OSTI. Order Number TI89004234/JAW.

This document provides comments, letters, responses, etc., concerning the impact of the Superconducting Super Collider. This document is prepared in compliance with federal regulations governing the preparation of the environmental impact statements. (FI)

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 7113

6342 **(DESY—87-036) Non-linear canonical formalism for the coupled synchro-betatron motion of protons with arbitrary energy.** Barber, D.P.; Ripken, G.; Schmidt, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). May 1987. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756096/JAW.

We investigate the motion of protons of arbitrary energy (below and above transition energy) in a storage ring. The motion is described both in terms of the fully six-dimensional formalism with the canonical variables x, p/sub x/, z, p/sub z/, σ = s - v/sub 0/ . t, eta = ΔE/E/sub 0/ = p/sub σ/ and in terms of a dispersion formalism with new variables x, p/sub x/, z, p/sub z/, σ, p/sub σ/ . Since the dispersion function is introduced into the equations of motion via a canonical transformation the symplectic structure of these equations is completely preserved. In this formulation it is then possible to define three uncoupled linear (unperturbed) oscillation modes which are described by phase ellipses. Perturbations manifest themselves as deviations from these ellipses. The equations of motion are solved within the framework of the fully six-dimensional formalism.

6343 **(INFN/TC—88-9) Slippage and superradiance in the high-gain FEL. Linear theory.** Bonifacio, R.; Maroli, C.; Piovella, N. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704516/JAW.

The linear regime of Free-Electron-Laser Amplifier is described taking into account propagation effects (slippage). It is demonstrated analytically, (for a simple case) the existence of two different solutions of pulse propagation equations, which in suitable limits describe the Steady-State and the Superradiant regimes.

6344 (INIS-SU—43, pp 45-47) **Numerical simulation of quasistationary relativistic electron beam dynamics in a dense gas.** Nauryzbaev, A.E.; Sorokin, G.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

Propagation of a quasistationary relativistic electron beam (REB) in a gas taking into account multiple electron scattering on gas atoms in numerically studied. The results obtained are compared with the profile equation solution. The profile equation is in good agreement with the results of numerical simulation in case of equilibrium beam injection into the gas. The effects of phase mixing result in fast damping of beam oscillations and consequently, the difference from the profile equation solution for nonequilibrium initial conditions. 6 refs.; 1 fig.

6345 (JINR-D—9-87-105-Vol.2, pp 181-184) **Linear accelerators with autoacceleration of a relativistic bunched beam.** Bogdanovich, B.Yu. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

A possibility of applying relativistic bunched beam radiation field energy for additional acceleration of charged particles is grounded and theoretically and experimentally confirmed. Original accelerator schemes based on autoacceleration of a relativistic bunched beam in the resonance systems are proposed. Test rig for investigating relativistic bunched electron beam autoacceleration is constructed. Experimental and theoretical investigation into two

basic LEA with the bunched beam autoacceleration is conducted. Experimental and theoretical results obtained as well as their comparative analysis allows one to make a conclusion concerning the truthfulness of the applied physical model of relativistic bunched beam autoacceleration and the efficiency of the proposed linear electron accelerator schemes. 24 refs.; 2 figs.

6346 (JINR-D—9-87-105-Vol.2, pp 185-188) **Adhezator with enchanced compression of electron rings.** Kuznetsov, A.B.; Prejzendorf, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

To reduce the electron ring radius in the ahezator of the collective heavy-ion accelerator a method of increasing the electron ring compression is proposed. This may be obtained by creation during injection in the adhezator of a non-uniform in radius magnetic field distribution at which the field in the center exceeds sufficiently the field in the injection orbit which leads to the reduction of the iniial generalized electron ring angular momentum. The calculations conducted show that the considered method of increasing the electron ring compression at the expence of reducing the generalized electron angular momentum may be applied both when reconstructing the existing adhezators and creating new ones. This method allows one to produce electron rinfs with the radius approximately twice as low as compared to compression in the field close to a uniform one. 6 refs.; 3 figs.

6347 (JINR-D—9-87-105-Vol.2, pp 242-245) **JINR phasotron accelerated beam stretching by means of c-electrode.** Glazov, A.A.; Zaplatin, E.N.; Kochkin, V.A.; Marchenko, B.N.; Onishchenko, L.M.; Shishlyannikov, P.T. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Beam stretching in the JINR phasotron consists in preliminary acceleration of particles up to the intermediate orbit and their subsequent acceleration to the final orbit at the necessary rate to obtain a continuous beam. When the particles reach the intermediate orbit basic dee accelerating voltage deenergization occurs. The particle additional acceleraion is performed using an additional C-electrode accelerating system. When conducting experiments on beam stretching (10/15)kV voltage was applied to C-electrode. Stretching regime optimization according to the beam shape consisted in choosing the time laws of frequency and amplitude change to provide for a complete beam filling during C-electrode operation under the maximum beam recapture coefficient. 4 refs.; 8 figs.

6348 **(LA-UR—88-3955) Facility for parity and time reversal experiments with intense epithermal (eV) neutron beams.** Bowman, C.D.; Bowman, J.D.; Herczeg, P.; Szymanski, J.; Yuan, V.W.; Anaya, J.M.; Mortensen, R.; Postma, H.; Delheij, P.P.J.; Baker, O.K. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-8808161—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003604/JAW.

From Workshop on on-line nuclear orientation and related topics; Oxford, UK (31 Aug 1988).

A facility for polarized epithermal neutrons of high intensity is set up at the Los Alamos National Laboratory for parity-violation and time reversal experiments at neutron resonances over a wide range of neutron energies. The beam is polarized with the aid of a polarized proton target used as a neutron-spin filter. Total cross section measurements as well as capture gamma-ray experiments will be carried out. The main features of this system will be discussed. 20 refs., 5 figs.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 6366

6349 **(BNL—41811) Beam line X-11A at the NSLS [National Synchrotron Light Source]: A unique facility for x-ray absorption spectroscopy.** Heald, S.M.; Sayers, D.E. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 17p. (CONF-8808141—4). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002177/JAW.

From 3. international conference on synchrotron radiation instrumentation; Tokyo, Japan (29 Aug 1988).

The design and operation of beam line X-11A at the NSLS is described. It employs a unique optical design using a two/four crystal monochromator and a SiC collimating mirror. In either two or four crystal mode a sagittal focusing crystal allows collection of up to 5 mrad of horizontal divergence. Two techniques for rapid scanning of a sagitally focusing crystal will be described and compared. These are dynamically bending the crystal during the scan or translating a fixed radius bent crystal in a manner to maintain a fixed focus on the sample. The flexibility of this two/four crystal design allows the intensity and/or resolution of the beam line to be optimized for particular experiments. 4 refs., 6 figs.

6350 **(CONF-881151—39) Operating experience of an ECR ion source on a high voltage platform.** Pardo, R. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003949/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The ATLAS PII-ECR ion source is the first ECR ion source to be designed for operation on a high voltage platform. The source system is required to provide beams of heavy ions with a velocity of 0.01c for subsequent acceleration by the superconducting ATLAS Positive Ion Injector linac. The ability of the system to provide high charge state ions with velocities up to .01c is possibly unique in the world today and as such has generated significant interest in the atomic physics community. A beamline for atomic physics has been installed and is now in use. The source began operation in October, 1987. The source capabilities and operating experience to date will be discussed. Other ECR-accelerator combinations will be compared to the ATLAS system. 10 refs., 3 figs., 3 tabs.

6351 **(DOE/ER/40155—1-Vol.2) Quench protection diode irradiation tests by the Texas Accelerator Center.** Carcagno, R.; Weichold, M.; Welch, G.; Ziegler, J. (Texas Accelerator Center, The Woodlands). 14 Jul 1986. Contract AC02-84ER40155. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003358/JAW.

To date considerable progress has been made in the first stage of the TAC program to assess the use of Quench protection diodes (QPD) within the cold region of the SSC superconducting magnets. Our principle goal in this period was to experimentally obtain information that will assist us in designing apparatus for future tests. More specifically, we wished to address the following areas of uncertainty: operational difficulties associated with installing and operating an experiment at a nuclear reactor; diode behavior when subjected to neutron radiation while held close to the temperature of liquid nitrogen; and the extent to which diodes can be annealed by heating them up to 593{degree}K. To gain information in these areas, we performed an irradiation of sixteen Westinghouse diodes at the Texas A and M Nuclear Science Center reactor. In the interest of avoiding the expense and long lead times associated with obtaining new equipment, we used apparatus that was on hand or which could be quickly obtained or constructed. Further tests of the irradiated diodes and analysis of the data already acquired will be continuing for some time, but the results already available will allow us to proceed with designing apparatus for accurate and reliable irradiation testing of diodes. The following is a summary of what we have learned in the three areas mentioned above, some cautions about interpreting the data, and the implications of this new information for our future activities. 14 figs., 1 tab.

6352 **(INFN/TC—88-16) Mechanical thermal and electric measurements on materials and components of the main coils of the Milan superconducting cyclotron.** Acerbi, E.; Rossi, L. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704518/JAW.

The coils of the Milan Superconducting Cyclotron are the largest superconducting devices built up to now in Italy and constitute the first superconducting magnet for accelerator in Europe. Because of the large stored energy (more than 40 MJ), of the high stresses and of of the need of reliability, a lot of measurements were carried out as well on materials used for the coils, both on superconducting cable and structural materials, as on the main components of the coils and on two double pancakes prototypes (wound with full copper cable). In this paper the results on these measurements are reported and the results of tests on the prototypes are discussed. The aim is to provide an easy source of data for superconducting coils useful to verify calculations or to improve the performances.

6353 (INIS-SU—62/A, pp 182-184) **Status of the optically pumped H/sup -/ ion source at the TRIUMF.** Law, W.M.; Levy, C.P.; Schmor, P.W.; Uegaki, J. (TRIUMF, Vancouver, British Columbia (Canada)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The status of the TRIUMF optically pumped polarized H/sup -/ ion source is given. The source can produce an H/sup -/ beam current of {similar←to}10 μA with nuclear polarization > 60%. A critical step in the source is transfer of polarization from the sodium to the neutral hydrogen emerging from the cell. The emittance growth of the final H/sup -/ beam due to the ionizer magnetic field has been measured. The normalized emittances of the H/sup -/ beam at a 2 kG ionizer field and of the H/sup 0/ beam accepted by the ionizer, corresponding to H/sup -/ ionizer zero field emittance, are 0.5 and 0.07, respectively, in units of π mm-mrad. These values correspond to an ionizer diameter of 1.2 cm are given at 60% contour level. 5 refs.; 1 fig.

6354 (INIS-SU—62/A, pp 221-223) **Dynamic proton and deuteron polarization in irradiated NH/sub 3/ and ND/sub 3/ at 1K and 0.5 K.** Belayev, A.A.; Get'man, V.A.; Dzyubak, A.P. and others. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Ammonia NH/sub 3/ and a deuterated analog material ND/sub 3/ having relatively high polarizable content and high resistivity to radiation damage are finding ever increasing use as target materials. This paper presents the results for the dynamic proton and deuteron polarization in NH/sub 3/ and ND/sub 3/ irradiated in a cryostat of a polarized proton target under "low temperature" conditions (0.5-1 K and 2.7 T). Slowly frozen NH/sub 3/ and ND/sub 3/ (t=1 hr at T/sub 9/3 K) are used. Irradiation with electrons was performed at the 2 GeV linac. To anneal the target material it was lifted up to the top of the cryostat and stayed at desired temperature for 0.5 hr. The proton polarization in NH/sub 3/ was measured by conventional technique described elsewhere. 7 refs.; 3 figs.

6355 (INIS-SU—62/A, pp 228-232) **Polarized targets at LAMPF.** Jarmer, J.J.; Penttila, S. (Los Alamos National Lab., NM (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Longitudinal frozen spin target used to measure the R and A parameters for π/sup +-/+p-vector -> π/sup +-/+p-vector scattering and a vertical continuously polarizing target for measuring the π-vector+p-vector -> n+p spin correlation parameter are described. Both targets are polarized by the method of dynamic nuclear polarization. The targets operate about five months, with about two months required for installation, setup, and testing. The operational charateristics of these targets along with LAMPF's capabilities for mounting other polarized target experiments and plans fro dynamically polarized nuclear (A>2) targets are described too. 14 refs.; 1 fig.; 3 tabs.

6356 (INIS-SU—68, pp 391) **Monitor of charged particle low-intensity beam position and profile on base of thin-film breakdown counters.** Batozhok, A.P.; Gorshkov, I.Yu.; Dashevskij, A.G.; Smirnov, A.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6357 **(JINR—R-9-87-869) Calculation of the system for ion axial injection into the U-200 isochronous cyclotron.** Vinogradov, Yu.B.; Gikal, B.N.; Gul'bekyan, G.G.; Kalchev, D.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1987. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704648/JAW.

An axial injection system is calculated for injection of ion beams (A/Z=2.8-5) into the U-200 isochronous cyclotron, its basic performance characteristics are discussed. Transport channel consisting of solenoids, magnetic lenses and electrostatic mirror are calculated by TRANSPORT program. Acceptance of the system is in good agreement with the beam emittance of 313/sup π/ mmxmrad. Numerical optimization of mirror parameters is presented. The calculated beam envelope in the central region agrees well the measurements. 6 refs.; 8 figs.

6358 (JINR-D—9-87-105-Vol.2, pp 174-177) **Extraction of constant operating beam for proton therapy at the LIYaF synchrocyclotron.** Abrosimov, N.K.; Aleksandrov, A.A.; Volchenkov, V.A. and others. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

To form a medical beam of a fan of particles which are not accepted into extraction magnetic channel at the LIYaF synchrocyclotron investigation into the size of this fan, current density and motion direction is conducted. Based on the investigation the basic part of the second beam extraction channel was created. The second beam magnetic channel located in the accelerator chamber appears to be one of the main elements of this channel. The channel provides for the field rise at the axial trajectory δ=2.3 kGs and for horizontally focusing gradient G=600 Gs/cm at 70 cm channel length. The optimal channel position obtained agrees well with the calculated value. The second beam intensity at the focus point at the distance of the order of 1.5 m from the lens doublet is equal to 1.06x10/sup 10/s/sup -1/ with the main beam intensity being 2.07x10/sup 12/s/sup -1/, i.e. the second beam makes up 0.5% as related to the main one. 4 refs.; 6 figs.; 1 tab.

6359 (JINR-D—9-87-105-Vol.2, pp 233-236) **Application of orbit expansion effect in the DTs-1 cyclotron beam extraction system.** Borisov, O.N.; Dmitrievskij, V.P.; Karamysheva, G.A.; Kol'ga, V.V.; Lomakina, O.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Results of numeric investigations into the DTs-1 sector-focused cyclotron design parameters are presented. The cyclotron is designed for deutron acceleration within 15+100 MeV range. For this purpose a program pack for the ES-1010 computer is written. The investigation conducted has shown that the problem of beam extraction from the DTs-1 cyclotron can be successfully solved by means of equilibrium orbit expansion effect application. 6 refs.; 4 figs.

6360 (JINR-D—9-87-105-Vol.2, pp 237-241) **Proton beam extraction from the JINR phasotron.** Dmitrievskij, V.P.; Zaplatin, N.L.; Novgorodov, A.F.; Onishchenko, L.M.; Polferov, Eh.A.; Chesnov, A.F.; Shabashov, M.F. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Results of experiments on the proton beam extraction from the JINR phasotron are presented. The system of 680 MeV proton extraction is a linear regenerative system. It comprises the elements of built-up of radial oscillations (exciter and regenerator with 0.031 and 0.027 T/cm respectively) and an iron-current deflecting channel with septum thickness at the inlet making up 0.4 cm. The extraction efficiency made up over 50% with the beam size at the inlet of the transport system being (3x0.8)cm. The results obtained agree well with the expected ones. 11 refs.; 6 figs.

6361 (JINR-D—9-87-105-Vol.2, pp 246-249) **Multiturn injection of a high-current beam into a proton storage ring.** Kurbangaliev, N.M.; Moiseev, V.A.; Ostroumov, P.N. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

As applied to the Moscow meson facory storage ring the process of multiturn spiral charge-exchange injection of H/sup -/ into a proton storage ring is investigated and results of numeric simulation of four-dimentional phase volume filling are presented. Problem concerning the possibility of realising multiturn spiral injection only at the expence of equilibrium orbit displacement is considered. The results obtained show that under multiturn spiral injection the number of particle transmission through the charge-exchange target may be reduced by an order and more as compared to the earlier proposed method which must sufficiently increase the charge-exchange target lifetime. Besides, the stored beam extraction from the target occurs automatically. It is stressed that although betatron oscillation frquencies in the designed storage ring operation modes are not optimal for spiral injection realization, it is possible to select such an equilibrium orbit displacement law at which transmission coefficient is sufficiently low, when applying the methods described. 4 refs.; 4 figs.

6362 (JINR-D—9-87-105-Vol.2, pp 143-146) **System for formation of complex profiled irradiation fields of a medicine electron linac.** Vikulov, V.F.; Vinogradov, K.A.; Garmash, A.G.; Gubanov, A.V.; Solomakhin, V.I.; Tron', A.M. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Results of development of a system for formation and control of complex profiled irradiation fields (IF) for LUEhR-40 M medical accelerator with 5-40 MeV energy are presented. A magnet creating a magnetic field with two interorthigonal components scans the beam along the irradiation field and magnetic quadrupole lenses keep the beam size in IF constant in the course of scanning at the expence of changing the focusing distances according to the assigned law. In compbination with the energy and mean accelerator beam current variation this allows one to realize the required IF. Tolerances for formation system parameters are developed. Under comparatively small sizes, weight and power consumption the system allows one to rapidly form the required irradiation fields increasing sufficiently the capacity and degree of automatization of the treatment process at the therapeutical facilities. 5 refs.; 2 figs.; 2 tabs.

6363 (JINR-D—9-87-105-Vol.2, pp 221-223) **On-line control system for the LIYaF AN SSSR synchrocyclotron beamlines.** Abrosimov, N.K.; Gerasimov, A.M.; Korovina, L.A.; Kryshen', L.M.; Mikheev, G.F.; Ryabov, G.A. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

During a number of years works on proton beamline reconstruction are conducted at the LIYaF synchrocyclotron. The reconstruction is aimed at on-line beam transport to the target. Resulting from the presented peculiarity analysis a traditional (for the system development period) structure of an on-line control system with a two-level hierarchy-the SM computer at the higher level and the "Elektronika-60" type computer-at the lower one, and the star-like configuration of the lower level computer connection to the higher one was accepted. Currently the following lower level subsystems are realized: a control subsystem for current stabilization in magnetic elements, beam shape measurement subsystem, collimator control subsystem, target device control subsystem. Radiation monitoring and magnetic measurement subsystems are being commissioned. Main trends in the further developing and increasing the system efficiency are enumerated. 5 refs.; 1 fig.

4304 Storage Rings

REFER ALSO TO CITATION(S) 6361, 6570

6364 **(DESY—87-037) Chromatic corrections and dynamic aperture in the HERA electron ring. Pt. 2.** Brinkmann, R.; Willeke, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). May 1987. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756097/JAW.

Sextupole distributions for various values of phase advance per FODO cell (phi/sub c/ = 60/sup 0/ ... 90/sup 0/) in the HERA electron ring are investigated. The chromatic corrections reduce the changes of the beta-functions to less than 5% and the changes of tunes to less than 0.01 in an energy range between -1% and 1%. The nonlinear acceptance accomodates at least 13 σ for a 35 GeV electron beam in the whole range of phi/sub c/. The scaling of the dynamic aperture with phi/sub c/ is found to be in good agreement with a simple analytical estimate.

6365 **(DESY-SR—88-04) The hard x-ray wiggler (HARWI) beamline at hasylab.** Hahn, U.; Graeff, W.; Weiner, E.W.; Bittner, L. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Hamburger Synchrotronstrahlungslabor). Jul 1988. 8p. (CONF-880552—11). NTIS (US Sales Only), PC A02. Order Number DE89003211/JAW.

From Topical conference on vacuum design of advanced and compact synchrotron light sources; Upton, NY, USA (16 May 1988).

The hard x-ray wiggler (W2) at the storage ring DORIS can provide very high power densities to beamline components. We present the beamline design between the storage ring outlet and the entrance flange of the experiment. Our emphasis is put on the constructive solution for all the components which are subject to beam heating like different absorbers and Be windows. Finally the basic idea of the vacuum interlock system is presented. 5 refs., 5 figs., 1 tab.

6366 (JINR-D—9-87-105-Vol.2, pp 250-252) **Target for slow extraction of particles from the Moscow meson factory proton storage ring.** Kazarnovskij, M.V.; Lobashev, V.M.; Ostroumov, P.N.; Ponomarev, O.V.; Severgin, Yu.P. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij; Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

One of the operating modes of the designed proton storage of the Moscow meson factory will consist in the uniform by azimuth accelerator vacuum chamber filling with a current pulse with subsequent slow extraction of the beam in the interval beween two subsequent accelerator pulses. Slow extraction from the storage is accomplished by means of transverse betatron oscillation excitation under smooth beam guidance onto a thin internal target. It was pro-

posed to use a "tooth"-like target for extraction in a radial plane. As compared to a traditional target in the form of a plate with a smooth edge, application of the tooth-like target leads to the reduction of the vertical beam emittance. Besides, the perimeter of the contact with the beam is reduced which decreases the number of particles which have transmitted incomplete target thickness. Results of the quantitative analysis of a horizontal extraction with a tooth-like target are presented. Sufficient beam radiation effect on the target leads to destruction of the graphite structure, to a certain worsening of its thermophysical properties. Therefore it is assumed to alternately use several targets and make the target node removable. Protection of equipment surrounding the target unit against secondary particle action is also necessary. 5 refs.; 6 figs.

44 INSTRUMENTATION

6367 **(EUR-CEA-FC—1348) Medium-distance, low jitter fiber-optic transmission of timing signals in nuclear instrumentation.** Coulon, J.P.; Hesse, M.; Platz, P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jun 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756126/JAW.

The performance of fiber optic links for the transmission of fast NIM-standard signals was studied. Temperature, pulse rate, and radiation damage effects were investigated. The links are part of the readout electronics of a position encoded X-ray detector. Tests show that fast timing signals can be transmitted over distances of at least 100m with very little jitter (<100ps). The effects of drastically changing experimental conditions such as temperature (-10 to +70C) and pulse rate (102 to 7.105/sec) can be eliminated by differential measurements (double-fiber link) or recalibration. Moderate loss of optical power 50%) due to radiation damage can also be tolerated. The fiber optic links do not significantly degrade spatial resolution whatever the photon rates and circuit temperature may be.

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 6020, 6422

6368 **(CERN-EP—88-88) Experimental results obtained from a low-Z, fine-grained electromagnetic calorimeters.** De Winter, K.; Geiregat, D.; Vilain, P.; Wilquet, G.; Bergsma, F.; Binder, U.; Burkard, H.; Capone, A.; Ereditato, A.; Flegel, W. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Jul 1988. 19p. (CONF-8803159—3). NTIS (US Sales Only), PC A03. Order Number DE89003198/JAW.

From 3. topical seminar on perspectives for experimental apparatus at future high-energy machines and underground laboratories; San Miniato, Italy (7 Mar 1988).

We report on experimental results obtained with the neutrino target calorimeter of the CHARM II detector. The experiment is being performed at CERN and its aim is to measure sin{sup 2}{theta}{sub w}, the electroweak mixing parameter, via the study of neutrino-electron scattering. The detector, installed on the SPS neutrino wide-band beam line, consists of a glass calorimeter instrumented with plastic streamer tubes and scintillation counters, and of a muon spectrometer. The performance of the calorimeter has been explored during a test run with electron and pion beams. Results concerning the detector response, the energy and angular resolution, and the e/{pi} separation are presented here. 5 refs., 16 figs.

6369 **(CERN-EP—88-115) Silicon detector tests with the RAL Microplex readout chip.** Joyce, D.; Merlo, J.P.; Morgan, K.; Smith, D.; Baumard, L.; Vuillemin, V.; Pimia, M.; Ellison, J.; Siotis, I.; Taylor, L. (European Organization for Nuclear Research, Geneva (Switzerland)). 6 Sep 1988. Contract FG03-86ER40271. 16p. (CONF-8806235—6). NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89003205/JAW.

From International conference on advanced technology and particle physics; Como, Italy (12 Jun 1988).

The design, construction and operation of a 5 layer silicon microstrip detector is described. The detector consisted of silicon microstrip wafers bonded to the RAL Microplex MX2 readout chip. The readout chip provided amplification with double-correlated sampling for each microstrip channel and multiplexing of 128 signals. The circuitry controlling the chip, the readout electronics, the stage holding the microstrip wafers and their alignment, are also described. A single-strip resolution of 10{plus+-minus}0.6{mu}m was obtained in a test beam. This work is part of a program to design a microvertex detector for the UA1 experiment at the CERN ppbar collider. 6 refs., 7 figs.

6370 **(CONF-8808161—1) UNISOR on-line nuclear orientation facility (UNISOR/NOF).** Girit, I.C.; Alton, G.D.; Bingham, C.R.; Carter, H.K.; Simpson, M.L.; Cole, J.D.; Croft, W.L.; Hamilton, J.H.; Jones, E.F.; Gore, P.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400;AS05-76ER05034;AC07-76ID01570;AC05-76OR00033;FG05-87ER40361;FG06-87ER40345;FG05-88ER40418;FG05-84ER40159. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89002314/JAW.

From Workshop on on-line nuclear orientation and related topics; Oxford, UK (31 Aug 1988).

The UNISOR on-line nuclear orientation facility (UNISOR/NOF) consists of a ^{3}He--^{4}He dilution refrigerator on line to the isotope separator. Nuclei are implanted directly into a target foil which is soldered to the bottom accessed cold finger of the refrigerator. A 1.5 T superconducting magnet polarizes the ferromagnetic target foils and determines the axis of symmetry. Up to eight gamma detectors can be positioned around the refrigerator, each 9 cm from the target. A unique feature of this system is that the k = 4 term in the directional distribution function can be directly and unambiguously deduced so that a single solution for the mixing ratio can be found. The first on-line experiment at this facility reported here was a study of the decay of the ^{191}Hg and ^{193}Hg isotopes. 5 refs., 4 figs., 1 tab.

6371 **(DOE/ER/40039—24) Annual report for the high energy physics program at Texas A&M University: Report for April 1, 1988 to March 31, 1989.** Webb, R.C. (Texas A and M Univ., College Station (USA). Dept. of Physics). Nov 1988. Contract AS05-81ER40039. 49p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004326/JAW.

During the past twelve months our group has continued to reach new milestones in our various research initiatives. The most notable of these was the successful calibration of the CDF gas calorimetry systems in the new M-West test beam during the early part of 1988. This test beam run resulted in the measurement of all the necessary calibration constants needed to carry out the final analysis of the 1987 data and to set up for the current high luminosity data taking run in progress. Since May of this year the CDF collaboration has been involved in its second major data taking run. We currently have recorded over 800nb/sup {minus}1/ to tape, and we anticipate that this CDF run will place our group into the "discovery" phase for much of the "new" physics available at this center-of-mass energy. In addition to these CDF activities, our group has also been working on the mounting of the electronics for the first MACRO module presently being commissioned in the completed Gran Sasso experimental hall B. In the accompanying report we will present the details of these and other accomplishments which we were able to achieve this year and outline our group's plan for its continued participation in these research programs for the coming twelve month period (April 1, 1989--March 31, 1990). 16 refs., 21 figs., 1 tab.

6372 **(FRCEA-TH—85) Investigation and realization of an automatic device for the control and test of a photon tagging system.** Fallou, J.L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France)). Dec 1987. 81p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756133/JAW.

An intelligent control/test equipment for a monoenergetic photon production system was developed. The device enables simulations to be done outside experimental runs. Operation can be en-

tirely automatic, or controlled by the experimenters. The device is modular and conforms to CAMAC standards. The architecture of the system is based around a local bus which comprises a central unit and its memory; a programmable pulse generator; a switching circuit to test and control the various paths; and a unit to communicate with the acquisition system.

6373 **(IFVE-OEIUNK—87-172) Characteristics of cell-structure hadron calorimeter on the base of plastic scintillator mouldings.** Bityukov, S.I.; Semenov, V.K.; Yablokov, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704957/JAW.

Submitted to the journal Instrum. Exp. Tech. .

Design features are considered and the results of measurements of the characteristics of a full-scale hadron calorimeter with 1 m/sup 2/ aperture, about 8 t in weight and the 10x10 cm cell are presented. The polysterene scintillator made by the moulding method has been used in the calorimeter. The calorimeter is aimed at measuring neutron energy in experiments with hyperon beams. The calorimeter possesses a good spatial (14 mm at 37.5 GeV energy) and energy ($0.7/\sqrt{E}$) resolution and permits to detect both charged and neutral hadrons in the wide energy range. The calorimeter is easily producible and reliable in operation. The calorimetr design permits to assemble detectors of a large aperture by joining of some modules with 1x1 m cross section. 22 refs.; 5 figs.

6374 **(INFN/TC—88-15) Transparent Δ gas detector for heavy ions.** Bonomo, F.; Tuve, C.; Romanski, J.; Barna, R.; De Pasquale, D. (Istituto Nazionale di Fisica Nucleare, Catania (Italy); Uniwersytet Jagiellonski, Krakow (Poland). Obserwatorium Astronomiczne; Messina Univ. (Italy). Ist. di Fisica). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704517/JAW.

A small, 50x60x50 mm/sup 3/ gas chamber was realized to be used as transparent Δ detector in front of solid state position sensitive detectors (PSD). It has two rectangular openings, covered by thin polypropylene foils (t≅000 A). The electrical field is along the particle trajectori, with electron collection at the centre of the chamber. Tests by /sup 12/C ions of E/sub 1ab/≅4 MeV, done using the chamber in telescope with a silicon PSD, have shown its good linearity and energy resolution.

6375 (INIS-SU—68, pp 393) **Multichannel distributed system for charged particle identification.** Ignatenko, A.V.; Lebedev, V.M.; Spasskij, A.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6376 (INIS-SU—68, pp 390) **Installation for studying three-particle nuclear reactions in complanar and noncomplanar configurations.** Gajdaenko, S.A.; Gorpinich, O.K.; Kadkin, E.P.; Kondrat'ev, S.N.; Kumshaev, S.B.; Pasechnik, M.V.; Saltykov, L.S. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6377 (INIS-SU—68, pp 392) **High-ionizing radiation detection by a detector with SHF biasing.** Mezentsev, A.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6378 (INIS-SU—68, pp 363) **MASEh facility and the first experiments.** Buranov, V.V.; Venikov, N.I.; Glukhov, Yu.A.; Dobychin, A.M.; Ogloblin, A.A.; Sakuta, S.B.; Tarasov, Yu.F.; Unezhev, V.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6379 (INIS-SU—68, pp 394) **Identification of background lines in experiments on reactor fast neutron inelastic scattering.** Lysikov, Yu.A.; Adymov, Zh.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6380 **(INS-T—477) Beam pipe system of the TOPAZ detector.** Morimoto, Teruhisa; Yoshioka, Masakazu. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Dec 1987. 21p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755498/JAW.

A beam pipe system of the TOPAZ detector is constructed. The beam pipe is made of aluminium and is consisted of a thin walled pipe at the collision point with an inner diameter of 178 mm, a pipe with a cylindrical distributed ion pump and a pipe at the luminosity monitor. The beam pipe and the masking system are designed to reduce the background due to the synchrotron radiation from the quadruple magnets and the off-momentum electrons caused by the beam-gas bremsstrahlung.

6381 **(INS-T—480) Construction of silica aerogel Cerenkov counter and its performance for PIK spectrometer.** Toyama, S.; Yamanoi, Y.; Okuda, K.; Nagoshi, C.; Noumi, H.; Fukuda, M.; Soga, F.; Hashimoto, O. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Apr 1988. 32p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755499/JAW.

A 1 m x 1 m aerogel Cerenkov counter wall has been constructed as a part of a trigger counter system for a magnetic spectrometer in 1 GeV/c region. The spectrometer was installed for the study of hypernuclei via (π,K) reactions in K2 experimental area of the 12 GeV proton synchrotron at National Laboratory for High Energy Physics (KEK). It is of vital importance for the spectrometer to have good kaon trigger system, since the cross section of the (π,K) reaction leading to hypernuclear states are small (< 10 μb/sr). In the present work, we have established a mass production method of silica aerogel by automating and improving procedures of its production. Over 200 blocks of silica aerogels were produced for the trigger counter of the spectrometer. Silica aerogel is an ideal Cerenkov radiator to suppress pion back ground in the momentum region around 1 GeV/c, since it is sensitive only to pions but not to kaons. It can have refractive index from 1.015 to 1.15 depending on the way it is produced. The counter system has three layers and consists of 27 counter modules. Each counter module with 45 x 15 x 3 cm sensitive volume has 6 silica aerogel blocks (15 x 15 x 3 cm). With a 5" phototube (HAHAMATSU R1250-03) for each counter module, we obtained on the average 4.3 photo electrons and achieved 98.6 % efficiency for 0.72 GeV/c pions at the central point of radiator. The silica aerogel Cerenkov counter system with three layers of wall had overall efficiency better than 99 % for pion events in the (π,K) experiment.

6382 **(JAERI-M—88-144) Measurement of the neutron spectrum at the pneumatic irradiation facility in JRR-4 reactor.** Liu, Han-Kang; Tanaka, Shun-ichi; Nakashima, Hiroshi. (Southwest Inst. of Nuclear Physics and Chemistry (China)). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755521/JAW.

A neutron spectrum from thermal to about 18 MeV at the irradiation position of the pneumatic facility in Japan Research Reactor (JRR-4 reactor) of JAERI was measured using the activation method with the SAND-II unfolding code. In the measurement, 6 kinds of resonance detectors and 12 kinds of threshold detectors

were used. The intensity of gamma rays from the activation detectors was measured with a Ge detector within an error of about 5 %. The reaction rates were measured with an accuracy less than 12.6 %. Further, a P-I-N neutron dosimeter and a LiF thermoluminescent dosimeter (TLD) covered with a boron carbide neutron absorber were applied to enhance the accuracy of the unfolded spectrum in the energy range from intermediate to 1 MeV, and it was made clear that the dosimeters were effective.

6383 **(JINR—E-10-88-28) Method of syndrome coding and its application for data compression and processing in high energy physics experiments.** Nikityuk, N.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704622/JAW.

Submitted to the 1-st International Joint Conference of ISSAC-88 and AAECC-6, Roma, July, 1988.

The questions of using the theory and practice of correcting codes for data compression and processing in multichannel detectors (hodoscopic systems) of nuclear particles are described. A system of analogies between the theories of correcting codes and hodoscopic systems is considered. The following problems are supposed to be solved by syndrome coding: the use of syndrome coding for decreasing the number of registration channels in case of a limited multiplicity of registered events; the introduction of abundance into known codes, for example into the Gray code, with the aim of increasing the space resolution of a hodoscope. the main result of approach is the development of radically new electronic logic units, i.e. parallel encoders for t events (t>1) and special-purpose processors with algebraic structure (in the Galois field GF(2/ sup m/) for fast event selection in nuclear physics experiments. 18 refs.; 10 figs.; 1 tab.

6384 (KEK—87-26, pp 57-65) **Silicon semiconductor beta-ray detector.** Miyaji, Takashi; Ohkawa, Shoichi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1988. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780028/JAW. (CONF-8711247—).

From 1. workshop on the neutron lifetime; Oho, Japan (19 Nov 1987).

It was the pending question to comparatively examine the characteristics of the beta-ray detectors used for the precise experiment on neutron life. However, sufficient study has not yet been made about the details of the experimental method, therefore, the following conditions were temporarily set. Only electrons are detected at the final state of neutron decay. The identification of electrons in the neutron decay reaction is carried out by distinguishing it as the event allowable in a phase space. For the purpose, as the performance required for the detectors, the range of energy measurement is 100 - 800 keV, and the energy resolution is not more than 50 keV. The space of the decay region that the detectors cover is not larger than the cross section 15 x 15 cm/sup 2/ and the length 30 cm. A magnetic field is added. Under these conditions, the practically conceivable electron detectors are the following three types, that is gas amplification type chamber, plastic scintillation counter and silicon semiconductor detector. The silicon semiconductor detectors are practically usable as the detectors for this experiment, according to the investigation by the authors on the general matters, the material and the method of making the detectors. The plastic scintillation counters and the silicon semiconductor detectors are to be examined without making the final selection. (Kako, I.).

6385 **(LA-UR—88-3664) The new chopper spectrometer at LANSCE, PHAROS.** Robinson, R.A.; Nutter, M.; Silver, R.N.; Hooten, D.T.; Ricketts, R.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 11p. (CONF-8810182—6). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003606/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

We describe the new chopper spectrometer PHAROS under design at Los Alamos. It is intended to provide 0.5% incident energy resolution for incident energies between 50 MeV and 2 eV. This will be achieved with a methane moderator and a 20m incident flight path on Flight Path 16 of the Los Alamos Neutron Scattering Center. The secondary flight path will be 4m for scattering angles between 10{degree} and 140{degree}. For small scattering angles (down to 0.5{degree}), the secondary flight path can be extended to 10m. We include results of preliminary tests on phasing a prototype chopper and the Proton Storage Ring. These show that phasing can be achieved and that the width of the transmitted neutron pulse is in reasonable agreement with calculation. 5 refs., 4 figs., 1 tab.

6386 **(LA-UR—88-3673) Stabilized, hand-held, gamma-ray verification instrument for special nuclear materials.** Fehlau, P.E.; Wiig, G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-881103—16). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003467/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

For many years, Los Alamos has developed intelligent, hand-held, search instruments for use by non-specialists to search for special nuclear materials (SNM). The instruments sense SNM by detecting its emitted radiation with scintillation detectors monitored by digital alarm circuitry. Now, we have developed a new hand-held instrument that can verify the presence or absence of particular radioisotopes by analyzing gamma-ray spectra. The new instrument is similar to recent, microprocessor-based, search instruments, but has LED detector stabilization, three adjustable regions-of-interest, and additional operating programs for spectrum analysis. We call the new instrument an SNM verification instrument. Its spectrum analysis capability can verify the presence or absence of specific plutonium isotopes in containers or verify the presence of uranium and its enrichment. The instrument retains the search capability, light weight, and low-power requirement of its predecessors. Its ready portability, detector stabilization, and simple operation allow individuals with little technical training to verify the contents of SNM containers. 5 refs., 5 figs.

6387 **(ORNL/TM—10904) Sources of compensation in hadronic calorimeters.** Goodman, M.S.; Gabriel, T.A.; Di Ciaccio, A.; Wilson, R. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004387/JAW.

Monte Carlo simulations are presented using the CALOR code system to study the design of a large hybrid hadron calorimeter system employing a warm liquid active medium (tetramethylsilane, $Si(CH_3)_4$) and uranium plates in addition to a conventional Fe/plastic system. In the system described here, the uranium provides partial compensation by suppressing the electromagnetic cascade produced by incident electrons due to sampling inefficiencies. The results of the simulations also indicate that significant compensation is achieved (given small enough saturation) due to low energy recoil protons produced in collisions with low energy (1--20 MeV) cascade and fission neutrons in the active medium. Both compensation mechanisms are important to help balance the response of a calorimeter to incident electrons and hadrons, that is, to achieve a ratio of pulse heights ($e/h \sim 1$) which will lead to the best energy resolution. 17 refs., 4 figs., 2 tabs.

6388 **(PTB-ND—31) Response of two Bonner spheres for 2.5 and 14.7 MeV neutrons determined with two different methods.** Schuhmacher, H.; Guldbakke, S.; Klein, H.; Strzelczyk, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Neutronendosimetrie). Jun 1988. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756111/JAW.

The fluence response of a 3.5″ and a 9.5″ Bonner sphere detector system for monoenergetic neutrons of 2.5 MeV and 14.7 MeV has been measured. Two methods were applied to determine the corrections due to neutrons scattered by the air and the walls of the irradiation hall: the shadow-cone technique and the distance-variation technique. The agreement of the results obtained by the two methods shows that both can be applied to radiation fields produced at the accelerator facility. The influence of target-scattered neutrons on the determination of the fluence response is discussed.

6389 **(SLAC-PUB—4780) A fast integrating eight-bit bilinear ADC.** Biery, K.A.; Ouimette, D.A.; Ritchie, J.L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 3p. (CONF-881103—20). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003781/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

A fast gated charge integrating ADC has been developed for measuring short photomultiplier pulses at very high event rates. The circuit is bilinar with 100 pC full scale and a least count of 150 fC. It features dc coupling, a minimum gate width of 20 ns, a minimum time between events of 200 ns plus gate width, a two event buffer, and front-end zero suppression with 100 ns read time per hit channel. Five hundred channels have been built and installed in the rare K{sub L}{sup 0} decay experiment E791 at Brookhaven National Laboratory. 3 refs., 6 figs., 1 tab.

6390 **(SLAC-PUB—4785) Cerenkov ring imaging detector development: Progress report.** Aston, D.; Bienz, T.; Bird, F.; Dasu, S.; Dunwoodie, W.; Hallewell, G.; Kawahara, H.; Kwon, Y.; Leith, D.; Ratcliff, B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515;AT03-76ER70023. 6p. (CONF-881103—19). NTIS, PC A02/MF A01. Order Number DE89003780/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

We present recent progress on the construction and testing of the first drift boxes and single electron detectors as they come from the production line. These detectors will be used for particle identification using the Ring Imaging technique in the SLD experiment at SLAC. Various experimental results are presented, including single electron pulse height measurements as a function of gas gain, detector gating capability, uniformity of response across the wire plane, charge division performance of a single electron signal, average pulse shape and its comparison with predicted shape, and cross-talk. 14 refs., 11 figs.

6391 **(JINR—D-9-87-105-Vol.2) Proceedings of the 10. All-union conference on charged-particle accelerators. Vol. 2.** (AN SSSR, Moscow; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. 61p. (In Russian). (CONF-8610271—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW.

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

These are the proceedings of the 10th all-union conference on charged-particle accelerators.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

6392 **(ORNL/TM—10957) Shield Optimization Program: Part II, Effects of Van Allen Belt [VAB] radiation on SDI [Strategic Defense Initiative] weapon platforms.** Barnes, J.M.; Santoro, R.T.; Johnson, J.O.; Drischler, J.D.; Gabriel, T.A.; Smith, M.S. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004302/JAW.

The effects of both natural and man-made Van Allen Belt (VAB) radiation at an altitude of 500 km are presented for various components of a prototypic space-based interceptor (SBI) weapon platform. The weapon platform is described in detail and represents the authors' concept of such a system. The calculated results show that the SBI platform will survive long term (10 years) exposure to natural VAB protons and electrons. However, when the electron belts are enhanced by the detonation of a nuclear weapon, high levels of radiation can be expected in components mounted on or near the surface of the spacecraft. These dose levels are sufficient enough to produce damage in the most sensitive components. 12 refs., 3 figs., 15 tabs.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 5800, 6195, 6257, 6521, 7100

6393 **(DOE/ID/12558—2) Improved industrial humidity sensor: Final technical report.** (Honeywell, Inc., Plymouth, MN (USA). Solid State Electronics Div.). Apr 1988. Contract FC07-84ID12558. 126p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89002378/JAW.

The objective of this project was to develop an economic and accurate moisture sensing system; a capacitive dew point hygrometer for use in harsh drying operation environments. The system was developed to meet the performance and cost requirements of agricultural grain drying and other process drying applications. Accurate moisture sensing and control using this sensor may achieve energy savings through reducing overdrying and increasing productivity of agricultural and industrial drying processes. This report describes the results of the dew point sensor development effort. 45 figs.

6394 **(DOE/METC—88/4081) Operations manual for DOE/METC's second generation fiber optic alkali monitor and calibration device.** Logan, R.G.; Hensel, J.P.; Wachter, J.K.; Signor, R.B.; Crane, R.W. (USDOE Morgantown Energy Technology Center, WV). May 1988. 65p. NTIS, PC A04/MF A01 - OSTI. Order Number DE88001078/JAW.

The DOE/METC fiber optic alkali monitor is an integrated hardware and software system developed to monitor alkali concentrations in process gas streams. For additional information on the background, design and application of this fiber optic alkali monitor (and its predecessor version) the reader should consult the suggested reading list at the end of this report. A slipstream of the process gas is introduced into a controlled flame and the concentrations of sodium and potassium are monitored using flame emission spectroscopy. The system consists of three basic sections: the light gathering and distribution section, the light filtering and detection section, and the computer-controlled signal processing section. The light gathering and distribution section consists of four components: a lens arrangement, an optical shutter, a bifurcated fiber optic, and two beam splitters. The purpose of the lens arrangement is to reduce flame noise by spreading the image of the center of the flame and focusing it through the optical shutter onto the fiber optic. This technique serves to eliminate the adverse effects of flame movements. The optical shutter is a means to block out all light from the fiber optic bundle while performing dark calibrations. When the shutter is open, the gathered light travels through a bifurcated fiber optic to the sodium and potassium channels, where it is divided by the beam splitters. This beam-splitting technique distributes equal amounts of light between each of the two channels' foreground and background subchannels. The divided light beam then enters the filtering and detection section. 24 figs.

6395 **(LA-UR—88-3671) Water as a thermoacoustic working fluid.** Swift, G.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8811107—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003468/JAW.

From Acoustical Society meeting; Honolulu, HI, USA (11 Nov 1988).

This short report, addressed only to the thermoacoustic cognoscenti, discusses thermodynamic and transport properties of water with emphasis on water's virtues as a thermoacoustic working fluid. Short-stack-approximation calculations are presented, showing that water is a good working fluid. A very rough design for a sound source using water is also presented as a starting point for discussing the merits and difficulties of this technology. 4 figs.

6396 **(ORNL/TM—10983) Gain and electric field radiation pattern approximations for the E-plane horn antenna.** Ewing, P.D. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 41p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004305/JAW.

A gain and electric (E) field radiation pattern approximation can be used to avoid the complex mathematics and computation

methods typically required to calculate the gain and E field radiation pattern of the E-plane horn antenna. Using conventional techniques, the calculation of these antenna parameters involves solving the Fresnel integrals and the use of numerical integration. With the approximation model developed by the author, an estimate of the gain and E-plane radiation pattern can be determined using simple trigonometric terms. The criterion used to evaluate the accuracy of the approximations was that the approximated values fall within 3 dB of the calculated values. Under this criterion, the results showed that the gain approximation holds for a flare angle of less than 10{degree} for typical antenna dimensions and the E field radiation pattern approximation holds until the antenna's phase error approaches 60{degree}. 4 refs., 20 figs., 12 tabs.

6397 **(UCRL—50025-88-1) Electronics Engineering Department EE technical review: Dedicated issue image processing.** (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 65p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003709/JAW.

This issue of EE Technical Review is dedicated to the subject of image processing, a powerful analytical tool that can be used in a broad spectrum of applications. Image-processing technology has been available for quite some time, but was not widely used in the past because of limitations in computer technology. Now, however, significant increases in computer-processing capabilities have led to a remarkable upsurge of interest in the potential uses of image processing.

6398 **High sensitivity atmospheric transmission measurements using a cavity ringdown technique.** Ramponi, A.J.; Milanovich, F.P.; Kan, T.; Deacon, D. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94549). *Applied Optics;* **27**: No. 22, 4606-4608(15 Nov 1988).

The design and operation of an absorption spectrometer is described. The spectrometer isused to measure water vapor absorption in the ambient laboratory atmosphere.(AIP)

6399 **Moire method and zone plate pattern inaccuracies.** Vladimirsky, Y.; Koops, H.W.P. (Center for X-ray Optics, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* **6**: No. 6, 2142-2146(Nov 1988).

Moire patterns obtained from superimposed zone plates with common types of pattern inaccuracies are analyzed. Tolerances for the distortions characterized as ellipticity, radial displacement, and nonconcentricity of the zones, are obtained from the corresponding equations for lenses. The formulas for moire fringes resulting from superimposed zone plate patterns having these defects are derived. The feasibility of moire pattern techniques to detect and measure inaccuracies of the zone plate is demonstrated. The sensitivity and the limitations of the method are discussed.

6400 **Soft x-ray projection lithography using an x-ray reduction camera.** Hawryluk, A.M.; Seppala, L.G. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* **6**: No. 6, 2162-2166(Nov 1988).

Soft x-ray projection lithography can now be realized with recent developments in x-ray optics. Using new x-ray optical components and spherical imaging optics, we have designed an x-ray reduction camera which is capable of projecting with soft x-ray radiation, a 5 x demagnified image of a mask onto a resist coated wafer. The resolution of this design is {similar←to}00 nm with a depth of focus of +- 5.6 {mu}m and a 0.5-cm-diam image field. We use x-ray reflecting masks (patterned x-ray multilayer mirrors) which are fabricated on thick substrates and can be made relatively distortion free. Our design uses a laser produced plasma for the x-ray source. Better resolution and/or larger areas are possible with improvements in optic figures and source characteristics.

6401 **Optimization experiments with a double Gauss lens.** Brixner, B.; Klein, M.M. (Los Alamos National Lab., MS P915, Los Alamos, NM (US)). *Optical Engineering;* **27**: No. 5, 420-423(May 1988).

This paper describes how a lens can be generated by starting from plane surfaces. Three different experiments, using the Los Alamos National Laboratory optimization procedure, all converged on the same stable prescriptions in the optimum minimum region. The starts were made first from an already optimized lens appearing in the literature, then from a powerless plane-surfaces configuration, and finally from a crude Super Angulon configuration. In each case the result was a double Gauss lens, which suggests that this type of lens may be the best compact six-glass solution for one imaging problem: an f/2 aperture and a moderate field of view. The procedures and results are discussed in detail.

45 EXPLOSIONS AND EXPLOSIVES

6402 **Proximity fuze.** Harrison, T.R. (to Dept. of Energy). US Patent Application 6-071,952. 10 Jul 1987. 41p. Contract AC04-76DP00789. DE89000128 NTIS, PC A03/MF A01 - OSTI. Order Number DE89000128/JAW.

A proximity fuze system includes an optical ranging apparatus, a detonation circuit controlled by the optical ranging apparatus, and an explosive charge detonated by the detonation circuit. The optical ranging apparatus includes a pulsed laser light source for generating target ranging light pulses and optical reference light pulses. A single lens directs ranging pulses to a target and collects reflected light from the target. An optical fiber bundle is used for delaying the optical reference pulses to correspond to a predetermined distance from the target. The optical ranging apparatus includes circuitry for providing a first signal depending upon the light pulses reflected from the target, a second signal depending upon the light pulses from the optical delay fiber bundle, and an output signal when the first and second signals coincide with each other. The output signal occurs when the distance from the target is equal to the predetermined distance from the target. Additional circuitry distinguishes pulses reflected from the target from background solar radiation. 3 figs.

4501 Chemical

6403 **Explosive plane-wave lens.** Marsh, S.P. (to to the Dept. of Energy). US Patent Application 6-025,022. 12 Mar 1987. 18p. Contract W-7405-ENG-36. DE89000108 NTIS, PC A03/MF A01 - OSTI. Order Number DE89000108/JAW.

An explosive plane-wave air lens which enables a spherical wave form to be converted to a planar wave without the need to specially machine or shape explosive materials is described. A disc-shaped impactor having a greater thickness at its center than around its periphery is used to convert the spherical wave into a plane wave. When the wave reaches the impactor, the center of the impactor moves first because the spherical wave reaches the center of the impactor first. The wave strikes the impactor later in time as one moves radially along the impactor. Because the impactor is thinner as one moves radially outward, the velocity of the impactor is greater at the periphery than at the center. An acceptor explosive is positioned so that the impactor strikes the acceptor simultaneously. Consequently, a plane detonation wave is propagated through the acceptor explosive. 3 figs., 3 tabs.

4502 Nuclear

6404 **(UCID—21550) Indirect estimates of rock mass strength by projectile penetration tests, and other methods: An overview and discussion of relevance to the Nuclear Test Program.** Heuze, F.E. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 73p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003711/JAW.

This study was initiated in response to the following questions: "what rock mechanical properties, if any, can be back-estimated from projectile penetration tests in rock, in-situ?", and "what is the uncertainty in such estimates?" The questions were posed in the context of the LLNL Nuclear Test Containment Program, to better evaluate in-situ rock mass strength for enhanced predictions

of ground motions and containment. This motivation is quite different from the usual concern, in earth penetration studies, which is to improve estimates of loads on penetrating weapons. 240 refs., 31 figs., 4 tabs.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

6405 **(CEA-CONF—9460) Long-term environmental records from antarctic ice cores.** Jouzel, J.; Raisbeck, G.; Lorius, C.; Raynaud, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Laboratoire Rene Bernas, 91 - Orsay (FR); Laboratoire de Glaciologie et Geophysique de l'Environnement, 38 - Saint-Martin d'Heres (FR)). (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). Mar 1988. 29p. (In French). (CONF-8803177—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755593/JAW.

From Environmental record in glaciers; Berlin, F.R. Germany (13 Mar 1988).

Three deep Antarctic ice cores reach back in time at least into the last glaciation and one extends over the entire last climatic cycle (160.000 years). In comparison with current Holocene conditions, ice core studies suggest that the Last Glacial Maximum (around 20 kyr BP) was characterized by a much colder temperature, lower snow accumulation (possibly leading to a thinner ice sheet), higher continental and marine aerosol contents and a lower atmospheric CO/sub 2/ concentration. Over the last climatic cycle, large periodic temperature changes are observed with the coldest stages associated with atmospheric features similar to those of the LGM. In particular, a very close association between C0/sub 2/ and climate is observed throughout the record. Most of the recorded atmospheric changes are of global significance although quantitative interpretations will require further work. Ice core information relevant to cosmogenic isotopes, extraterrestrial matter and the oxygen cycle are also discussed.

6406 **(NP—9770129) Propagation of weak solar induced disturbances in the middle atmosphere.** Dameris, M. (Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie). 1987. 140p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770129/JAW.

The report investigates the reaction of the global system 'middle atmosphere' to weak disturbances caused by the solar activity in the temperature or pressure field of the upper stratosphere. A one-dimensional numerical dynamic model (0 to 80 km) and a global three-dimensional circulation model of the stratosphere (10 to 150 km) are used. Particular interest is taken in the propagation of disturbances in atmospheric strata below the level at which they are generated. The one-dimensional model is used for investigating general aspects of vertical wind disturbance propagation in a given stratum, either upward or downward. In the three-dimensional model, fluctuations in solar UV radiation resulting from the rotation of the sun induce significant temperature variations in the ozone layer in a zonal wind field of reduced stability. The temperature fluctuations, in turn, have a global effect on atmospheric circulation as a result of nonlinear wave-to-wave interactions.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 5787, 5789, 6115, 6147, 6156, 6218, 6518

6407 **(ANL/EES-TM—355-Vol.1) Error pattern evaluation and uncertainty quantification for a regional-scale (Lagrangian statistical trajectory) atmospheric transport and acid-deposition model: Volume 1, Main report.** Lazaro, M.A.; Shannon, J.D. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Feb 1988. Contract W-31109-ENG-38. 162p. NTIS, PC A08/MF A01 - OSTI. Order Number DE89003772/JAW.

The present study was intended to evaluate a range of statistical performance measures and to develop and test several new methods applied intensively to one model; however, the objectives and scope were still limited. Determination of the uncertainty in model-derived source/receptor relationships did not appear to be feasible from a comparison of the model predictions with the limited number of observations of deposition currently available. At best, it may be possible to estimate or place bounds on the uncertainty in predictions of deposition and to understand the character of those uncertainties. The performance of a model in predicting deposition and air-quality changes in response to large emission changes, outside the bounds of experience with historical evaluated data, cannot be confidently determined by the present methods. New approaches appear to be needed to provide a better understanding of the character of model errors and to estimate the uncertainties in future predictions within a limited domain, based on a comparison of predictions with historical observations. We hope that the results reported on here will be useful and can be applied to other models, as well as refined by further application with more extensive data. 82 refs., 37 figs., 26 tabs.

6408 **(ANL/EES-TM—355-Vol.2) Error pattern evaluation and uncertainty quantification for a regional-scale (Lagrangian statistical trajectory) atmospheric transport and acid-deposition model: Volume 2, Appendixes A-N.** Lazaro, M.A.; Shannon, J.D. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Feb 1988. Contract W-31109-ENG-38. 179p. NTIS, PC A08/MF A01 - OSTI. Order Number DE89003773/JAW.

This report contains 14 appendices which support the mathematical model developed in Volume 1. (TEM)

6409 **(CONF-8809129—2) Impact of kerosene heater usage on indoor NO_2 exposures in 50 East Tennessee homes.** Dudney, C.S.; Hawthorne, A.R.; Monar, K.P.; Cohen, M.A.; Spengler, J.D. (Oak Ridge National Lab., TN (USA); Harvard Univ., Boston, MA (USA). School of Public Health). 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01 - OSTI. Order Number DE88016813/JAW.

From APCA specialty conference on combustion processes and the quality of the indoor environment; Niagara Falls, NY, USA (27 Sep 1988).

As part of a study of indoor air quality in 300 houses in Roane County, Tennessee, a special study was made on kerosene heater usage and indoor pollutant levels, with emphasis on NO_2. Owners of 45 homes with kerosene heaters deployed pairs of passive NO_2 monitors on a weekly basis for ten weeks and recorded the weekly amount of heater use. Without correcting for house-specific factors, such as air exchange rate, indoor NO_2 levels were found to increase about 0.3 ppB per h/week of homeowner-reported heater use. In the absence of heater use, NO_2 levels were about 10 ppB in houses with and without kerosene heaters. In four houses with kerosene heaters and one house without, continuous measurements were made of NO, NO/sub x/, SO_2, and CO. CO and SO_2 levels increased threefold and tenfold, respectively, when the heater was operated compared to when it was off. Mean SO_2 levels during heater operation were 57, 46, and 110 ppB in three houses with radiant heaters and 13.5 ppB in one house with a convective heater. 5 refs., 8 figs., 3 tabs.

6410 (CONF-8809168—3) CO{sub 2}-induced climate change and forest resources. Graham, R.L.; Turner, M.G.; Dale, V.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003128/JAW.

From 2. US-USSR symposium on air pollution effects on vegetation; Gatlinburg, TN, USA (21 Sep 1988).

The objective of this paper is to examine potential forest responses to increases in atmospheric CO{sub 2} and to CO{sub 2}-induced climate change. Forests both affect and respond to changes in atmospheric CO{sub 2} and climate. Forests directly affect climate at the global scale by altering the earth's albedo, hydrological regimes, and atmospheric CO{sub 2}. At a local scale they can alter air temperature, humidity, and solar radiation. In turn, forests are affected by CO{sub 2} and climate at many spatial and temporal scales. Forest responses to CO{sub 2} and climate may be examined by using five biotic paradigms. Each paradigm has its own spatial and temporal scale and its own set of unique phenomena responsive to CO{sub 2} and climate changes. We will first use these paradigms to review forest responses to CO{sub 2} and climate. We will then describe the linkages between these paradigms and the implications of these linkages for future research on the impact of elevated atmospheric CO{sub 2} and climate change on forest resources. 51 refs., 1 fig.

6411 (DOE/ER/60549—2) Cancer risk for radon exposure in a polluted environment: Progress report, March 1, 1988--February 28, 1989. Burns, F.J. (New York Univ., NY (USA). Dept. of Environmental Medicine). 1989. Contract FG02-87ER60549. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003820/JAW.

The objective of this project is to produce data in rats relevant to evaluating radon cancer risks in polluted indoor environments. Rats are to be exposed by tracheal implant to an alpha source in combination with inhalation exposure to NO_2 or cigarette smoke. Direct measurement of DNA strand breaks in the respiratory epithelium will be made by alkaline elution. The carcinogenicity in the repsiratory epithelium of these treatments will be established in long term tests.

6412 (NP—9770106) International Commission for the Protection of the Rhine River Against Pollution. Annual report 1986. (Internationale Kommission zum Schutze des Rheins gegen Verunreinigung, Koblenz (Germany, F.R.)). 1987. 219p. (In German, French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770106/JAW.

The 1986 report reviews the activities of the Commission and gives an outline of the water quality of the Rhine river and its development in the last few years.

6413 (NP—9770136) Atmospheric deposition and internal turnover of heavy metals in forest ecosystems. Schmidt, M. (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1987. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770136/JAW.

This work intended to make a quantitative assessment of the dry deposition of the heavy metals lead, chromium, cadmium, zinc, iron, cobalt, copper, and manganese for two forest stands in the Solling mountain. The methodic approach was to fumigate some beech and spruce branches with filtered air and protect them from atmospheric deposition, thereby separating the internal turnover from external pollutant deposition. The flow rates of soil deposition, consisting of deposition from precipitation and litter, were determined for the portion taken up internally by the plant (root uptake and translocation to the crown) as compared to the deposition into the crown from the air. This experiment with the aid of curvettes was carried through for beech over the entire foliate period, for spruce over a full year without interruption.

6414 (OE—87-632) Evaluation of a new filter media for high volume sampling. Foster, B.A.; Kurtz, J. (Ontario Ministry of the Environment, Toronto (Canada)). 1987. 17p. (MICROLOG—88-01143). Ontario Ministry of the Environment, Communications Branch, 135 St. Clair Ave., West, 6th Floor, Toronto, Ont., Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In any air pollutant sampling program for total suspended particulates (TSP) and other contaminants, the filter medium plays an important part. This report concerns a comparison study on the collection properties of glass fiber and polyflon filters. Five pairs of high-volume filters were installed at locations in three Ontario cities, fitted with automatic flow controllers, and sampled 1600 m/ sup 3/ of air over a 24 hour period. In order to compare the properties of the two filter types, only pollutants found in significant concentration were studied. These included TSP, metals, sulfates, and nitrates. It was concluded that polyflon provides a filter medium with similar flow properties to glass fiber, as well as high efficiency for all particulates. It is chemically inert with respect to all gases, suffers little pressure drop, and has no severe clogging or hydroscopic problems. Its advantages are: reduced artifact effect for sulfur dioxide and NO/sub x/, thus providing a more accurate TSP; and ability to provide data on 24 elements with one analysis. The analytical techniques for glass fiber filter samples are labor-intensive, costly and susceptible to high blank corrections. The polyflon filter has a low level of metal impurities and very little blank correction is required. Disadvantages of polyflon filters are high cost, and inability for use in total carbon analysis. 12 refs., 5 figs., 16 tabs.

6415 (OE—8707) Air quality, northwestern Ontario. Annual report, 1986. Griffin, H.D. (Ontario Ministry of the Environment, Toronto (Canada)). 1987. 73p. (MICROLOG—88-01248). Ontario Ministry of the Environment, Communications Branch, 135 St. Clair Ave., West, 6th Floor, Toronto, Ont., Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents results of an air quality assessment program in northwestern Ontario. It includes data from communities where long term monitoring is conducted, mostly in urban areas and near industrial sources of air pollution such as mining, pulp and paper, and thermal power generation. Summaries are also presented of special studies in the Thunder Bay area. The monitoring program identifies pollution sources and assesses the results of pollution control measures. Data are included only on those contaminants routinely monitored in northwestern Ontario, including particulates, CO, fluoride, NO/sub x/, ozone, SO/sub 2/, total reduced sulfur, and heavy metals. Data from air quality and meteorological instruments are supplementd by vegetation, soil and snow sampling studies, and by predictions of pollutant levels with mathematical models. 19 refs, 12 figs., 25 tabs.

5003 Radioactive Materials Monitoring And Transport

6416 (CONF-881054—36) Comparison of PAVAN and XOQDOQ air concentration codes. Sabuncu, H.; Fields, D.E. (Oak Ridge National Lab., TN (USA); Atomenerjisi Komisyonu, Ankara (Turkey)). 1988. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89002343/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

An important part of any dose protection scheme is a means for predicting the transport and diffusion of emission by atmospheric winds and turbulence. Computerized atmospheric dispersion modeling systems have been implemented that use meteorological conditions and emission source terms as inputs. Two computer codes have been selected for simulating atmospheric dispersion and transport near Oak Ridge, Tennessee. Two of these codes are PAVAN and XOQDOQ. These codes access the joint frequency distribution of atmospheric wind speed, wind direction and stability class, a description of local complex terrain and other specific meteorological data which were collected at the Oak Ridge National

Laboratory Tower-C during calendar year 1987. This is the first application of these codes using Oak Ridge meteorological data. A large number of more complex dispersion models have been developed which appear to be more realistic representations of the physical processes involved. However, there is as yet no practical scheme for deriving values of input parameters for the models from easily available meteorological data. 5 refs., 2 figs.

5006 Regulations

REFER ALSO TO CITATION(S) 6075

6417 **(EPS—IP-75) An introduction to motor vehicle emissions inspection and maintenance programs.** Cope, D.L. (Environment Canada, Ottawa, Ontario. Environmental Protection Service). 1987. 76p. (MICROLOG—88-01167). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

New motor vehicles sold in Canada must limit emissions to levels required by government standards. However, it has been shown that tampering with emission control systems, misfuelling, and inadequte maintenance can result in pollutant emissions in excess of specified levels. In urban areas of Canada with chronic air pollution problems due in part to excess emissions from motor vehicles, an inspection and maintenance (I/M) program is a technique which could be used to reduce those excess emissions. An I/M program usually consists of a regularly scheduled inspection of vehicles to detect those emitting excess pollutants or with inoperative or missing pollution control equipment. The owners of vehicles which fail an inspection are required to have them repaired before the vehicles can be relicensed. Programs for light duty vehicles have been in operation in certain areas of the USA since 1974. Agencies considering the implementation of I/M in Canada have a large data base to consult when researching possible program types for their area. A phased approach is suggested. The first step would be an extensive publicity campaign to highlight the damage which results from tampering, misfuelling or insufficient maintenance. An education program would follow the publicity campaign along with a series of spot checks plus an analysis of airshed pollution sources. The latter two activities provide an agency with data for assessing the effectiveness and potential impact of an I/M program and its various components. 73 refs., 2 figs., 12 tabs.

6418 **(NP—9770141) Improvement of a procedure for the environmental hazard classification of new chemical substances. Final report. Pt. 2.** Klein, W.; Koerdel, W.; Kuhnen-Clausen, D.; Boose, C. (Fraunhofer-Institut fuer Umweltchemie und Oekotoxikologie, Schmallenberg (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). Oct 1986. 53p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770141/JAW.

Within the project a feasible, systematic and generally applicable computer based system has been developed ranking nature and extent of the hazard potential of a new substance and thus providing a basis for the hazard assessment and further measures to the evaluating agency. The system uses the base set data required for the notification of new substances according to Annex VII of the Directive 79/831/EEC. It provides sufficient flexibility to be able to consider single additionally required tests according to annex VIII of the Directive (level 1) and thus allows to extend the primary assessment by confirmation or reduction of the estimated hazard within the same system. This improvement of the EHR has been effected in cooperation with the French working group 'Chimie et Ecologie' which developed the CeE-system working with interactions. Quality and scoring of the base set data have been standardized in a way that the harmonized systems produce identical results.

6419 **(NP—9770142) Advancement of a method for environmental hazard ranking of new substances. Partial report 1.** Klein, W.; Koerdel, W.; Kuhnen-Clausen, D.; Boose, C. (Fraunhofer-Institut fuer Umweltchemie und Oekotoxikologie, Schmallenberg (Germany, F.R.)). Oct 1986. 47p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770142/JAW.

The project is to develop a simple, systematic and generally applicable, computer-aided system that is able to assess, on the basis of comparative evaluation, the type and extent of environmental hazardousness of a new substance, and thus offers the expert a basis for environmental hazard ranking and other measures. The system uses the data of the basic analysis and testing of new substances for which approval is applied for in accordance with Annex II of EC Directive 79/831, but is flexible enough to allow for subsequent, single examinations in accordance with Annex VIII of said Directive (stage 1), so that first ranking results can be modified within the same scheme. This advancement of the Environmental Hazard Ranking (EHR) scheme was done in cooperation with the French working group 'Chimie et Ecologie' who have developed the CeE-system based on interactions. After a harmonization of basic data for standard quality and weighting, both systems will come to the same results in environmental hazard ranking.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 5807

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 6413, 6439, 6497, 6504, 6505, 6506, 6507, 6508, 6509, 6510, 6518, 6524, 6525, 6526

6420 **(NP—9770113) Chemical material bills, internal proton production, and total acid load of soil in different forest ecosystems in northern Germany.** Bredemeier, M. (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1987. 198p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770113/JAW.

For different forest ecosystems in northern Germany, rates of deposition and internal production of acids are quantified from ecosystemal bills for chemical materials transport. The shares of external and internal sources in the total acid load are juxtaposed. Conclusions are drawn as to the further development of the chemism of the soil. The chemical materials and acid bills are evolved step by step; they are based on fundamentals of chemical theory regarding the methodics of billing chemical materials flow in forests. The forest ecosystems investigated represent different geographic, climatic, and orographic situations in northern Germany, different tree species, and different soil-chemical site properties.

6421 **(UCID—20941) Resource conservation and recovery act reauthorization, 3016 submittal, Livermore site and site 300.** Clelland, L. (Lawrence Livermore National Lab., CA (USA)). Dec 1986. Contract W-7405-ENG-48. 497p. NTIS, PC A21 - OSTI. Order Number DE89003851/JAW.

This document contains data compiled in partial fulfillment of Lawrence Livermore's reauthorization of the Resource Conservation and Recovery Act. No amplification of the purpose or source of the material is provided. (TEM)

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5917, 6080, 6492

6422 (MLM—3521, pp 16-18) **Rapid screening of soil for radioactivity.** Draper, D.G. Jul 1988. NTIS, PC A03/MF A01 - OSTI. Order Number DE88013959/JAW. Contract AC04-76DP00053.

In Technology Update - 88.

Decommissioning and decontamination (D&D) work, in which radioactive contamination is "cleaned up" to release buildings or equipment for nonradioactive work, is an ongoing project at Mound. In 1985, as part of a D&D program, soil contaminated with ^{238}Pu was designated for removal from the plant site. But the portable field instrumentation available could detect with accuracy only ten times the level of radioactivity that had been set as a release limit, while radiochemical analyses in the laboratory would have required nearly three days. Mound, therefore, designed an intermediate detection system that provides adequate sensitivity below the guideline value and rapid turnaround time. 2 refs., 1 fig., 1 tab.

6423 (ORNL/TM—10879) **Comments by a peer review panel on the computerized radiological risk investigation system (CRRIS).** Baker, D.A. (ed.). (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 113p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89004312/JAW.

This document represents the comprehensive review by experts of the documents describing the models, computer programs, and data bases making up the Computerized Radiological Risk Investigation System (CRRIS). The CRRIS methodology has been produced for the US Environmental Protection Agency's (EPA) Office of Radiation Programs (ORP) by the Health and Safety Research Division of Oak Ridge National Laboratory (ORNL) to assess the significance of releases of radioactive material from facilities handling such materials. The comments covered a wide range of aspects of the CRRIS models. Special review topics covered were uncertainty, validation, verification, and health effects. The reports making up the CRRIS documentation were reviewed in detail. The following are some of the more frequent comments about the methodology. This is a very comprehensive work, but too complex and hard to use. Too little explanation of some of the assumptions taken such as variance from standard ICRP organ weighting factors. Overly complex model for soil to root transfer and interception fraction. Gaussian plume model was used, when more state-of-art models are available. 35 refs.

6424 (PSI—16) **Migration chemistry and behaviour of iodine relevant to geological disposal of radioactive wastes. A literature review with a compilation of sorption data.** Liu, Y.; Gunten, H.R. von. (Paul Scherrer Institut, Wuerenlingen (Switzerland)). (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Sep 1988. 183p. NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS. Order Number DE88704971/JAW.

This report reviews the literature on iodine migration, chemistry and behaviour in the environment up to November 1987. It deals mainly with /sup 129/I released from a land repository, with particular consideration of the Swiss scenario for the disposal of low- and medium-level radioactive waste. As a background to this review, the basic properties of radioiodine, its distribution, circulation in nature and radiological impact are presented. A large number of sorption and diffusion data for iodine on rocks, sediments, minerals, cements and other materials have been compiled from many different laboratories. Based on this information, an assessment of the sorption and retardation of radioiodine in geomedia is made and methodologies for obtaining sorption distribution ratios (R/sub D/ values) are discussed. The review also covers natural analogue studies of /sup 129/I, retardation of iodine by cement barriers and the possible influences of organic compounds and microorganisms on the behaviour of iodine. Some possibilities for further research on diffusion measurements and near-field chemistry of radioiodine are outlined. (author) 259 refs., 9 figs., 32 tabs.

6425 (SKB-TR—88-02) **Migration of the fission products strontium, technetium, iodine, cesium, and the actinides neptunium, plutonium, americium in granitic rock.** Ittner, T.; Torstenfelt, B.; Allard, B. (Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Nuclear Chemistry; Linkoeping Univ. (Sweden). Dept. of Water in Environment and Society). (Swedish Nuclear Fuel and Waste Management Co., Stockholm; Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Nuclear Chemistry). Jan 1988. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756088/JAW.

Rock samples were taken from drilling cores in granitic and granodioritic rock, and small (2x2x2 cm) rock tablets from the drilling cores were exposed to a groundwater solution containing one of the studied elements at race levels. The concentration of the element versus penetration depth in the rock tablet was measured radiometrically. The sorption on the mineral faces and the migration into the rock was studied, by an autoradiographic technique. The cationic fission products strontium and cesium had apparent diffusivities of 10/sup -13/-10/sup -14/ m/sup 2//s. They migrate mainly in fissures or filled fractures containing e.g., calcite, epidote or chlorite or in veins with hgih capacity minerals (e.g. biotite). The anionic fission products iodine and technetium had apparent diffusivities of about 10/sup -14/ m/sup 2//s. These species migrate along mineral boundaries and in open fractures and to a minor extent in high capacity mineral veins. The migration of the actinides neptunium, plutonium and americium is very slow (in the mm-range after 2-3 years contact time). The apparent diffusivities were about 10/sup -15/ m/sup 2//s. The actinide migration into the rock was largely confined to fissures.

6426 (SKB-TR—88-08) **Diffusion in the matrix of granitic rock field test in the Stripa mine. Final report.** Birgersson, L.; Neretnieks, I. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Chemical Engineering). (Swedish Nuclear Fuel and Waste Management Co., Stockholm). Apr 1988. 155p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756090/JAW.

Three similar migration experiments in the matrix of granitic rock have been performed and are presented. The experiments have been carried out in 'undisturbed' rock, that is rock under its natural stress environment. Since the experiments were performed at the 360 m level in the Stripa mine (Stripa, Sweden). A mixture of three nonsorbing (conservative) tracers, Uranine, Cr-EDTA, and I/sup -/ , were injected into the granitic rock matrix for three different time periods: About 3 months, about 6 months, and about 3.5 years. The subsequent overcorings of the injection holes showed that the tracers had in some cases migrated at least about 400 mm (measuring limit) into the rock matrix for the experiment with the longest injection time. It could also be seen that there were large differences in migration distance into the rock matrix for samples taken fairly close to each other. The results from all three experiments showed that all three tracers had migrated through the disturbed zone close to the injection hole, through the fissure coating material, and a distance into the 'undisturbed' rock matrix.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 6308, 6328, 6329, 6330, 6331, 6332, 6333, 6334, 6335, 6336, 6337, 6338, 6339, 6340, 6341

6427 (DOE/OR/21548—043) **Army Vicinity Property No. 7, post-remedial action report: Weldon Spring Site remedial action project.** (MK-Ferguson Co., St. Charles, MO (USA); Jacobs Engineering Group, Inc., St. Charles, MO (USA)). Sep 1988. Contract AC05-86OR21548. 22p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003672/JAW.

This report documents remedial action efforts of the Project Management Contractor (PMC) in January, 1988 at Army Vicinity Property No. 7 (VP7) at the Weldon Spring Site Remedial Action Project (WSSRAP). Soil sample results and gamma radiation measurements made before, during and after the remedial action are included in Appendix A of this report. The results of soil samples and gamma radiation measurements made during and after the remedial

action indicate that VP7 now meets the US Department of Energy guidelines for residual radioactive material (US DOE, 1987) and the PMC recommends that it be released for unrestricted use. 2 refs., 2 figs., 2 tabs.

5106 Regulations

REFER ALSO TO CITATION(S) 6075, 6418, 6419, 6421

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 5807

6428 **(CWSO—8705) Assessment of the polar bear population in the eastern Beaufort Sea.** Sterling, I.; Andriashek, D.; Spencer, C.; Derocher, A. (Canadian Wildlife Service, Ottawa, Ontario). 1987. 32p. (MICROLOG—88-00273). Canadian Wildlife Service, 175 Woodward Dr., Ottawa, Ont., Canada K1A 0E7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objectives of this study are to determine the present size and vital parameters of the population of polar bears in the Beaufort Sea and Amundsen Gulf to compare these results with data collected in the 1970s, and if possible, to evaluate the effects of offshore hydrocarbon exploration and production on polar bears. In 1985 and 1986, 406 individual polar bears were tagged. No deaths were caused by the drugging and handling procedures. Preliminary examination of movement data continues to indicate a separation of the polar bear population along the mainland coast from that on the west coast of Banks Island and Amundsen Gulf. The average ages of males and females one year of age or greater were 7.01 and 7.43 for males and females respectively. Of the 191 males and 215 females handled, 45 (23.7%) and 57 (26.5%) were 10 years of age or greater. The mean litter size of cubs of the year was 1.94. Age specific natality rates were comparable to values calculated in the study area from 1971-79. Estimates of sex-specific annual survivorship, calculated from the combined 1985 and 1986 age structures, ranged from 87.0% to 88.5%. Preliminary estimates of population size in the study area in 1986, calculated from related data sets are 1373 +/- 274 standard deviation and 1459 +/- 392 standard deviaton. These estimates are lower, though probably not significantly so, than estimates made in the late 1970s. The present harvest is probably at maximum sustainable yield. 15 refs., 4 figs., 5 tabs.

6429 **(FO/ABS—Fs97-13/0637) Phytoplankton data from the southern Beaufort Sea.** Pinkewycz, N.; Hsiao, S.I.C. (Department of Fisheries and Oceans, St-Anne-de-Bellevue, Quebec (Canada). Arctic Biological Station). 1987. Vp. (MICROLOG—88-02914). Dept. of Fisheries and Oceans, Scientific Information and Publications Branch, 200 Kent Street, 12th. Floor, Ottawa, Ont., Canada K1A 0E6;MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Canadian portion of the continental shelf of the Beaufort Sea has been opened to exploratory drilling for oil and gas. A major impact on the environment would result from oil and gas discharged into the sea in the event of an underwater well blowout and/or a spill during transport. Such events would affect the primary production of phytoplankton, the basic food supporting higher animals. Species are used as indicators of water masses and are characteristic of prevailing ecological conditions. Water samples collected in the southern Beaufort Sea during the spring of 1975 were analyzed quantitatively for phytoplankton. Thirty-nine genera and 60 species were identified. The diatoms were represented by 42 species (9 centric and 33 pennate), the green algae by 5, the golden-yellow algae by 3, the euglenoids by 3, and the dinoflagellates by 7 species. The diatoms comprised the largest group in the terms of numbers of species and cells. 2 refs., 1 fig., 13 tabs.

6430 **(FO/ABS—Fs97-13/0644) Phytoplankton, temperature and salinity data from northeastern Ungava Bay.** Pinkewycz, N.; Fife, F.J.; Hsiao, I.C. (Department of Fisheries and Oceans, St-Anne-de-Bellevue, Quebec (Canada). Arctic Biological Station). 1987. 74p. (MICROLOG—88-02915). Dept. of Fisheries and Oceans, Scientific Information and Publications Branch, 200 Kent Street, 12th. Floor, Ottawa, Ont., Canada K1A 0E6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Recently Canadian offshore areas have been opened to exploration for oil, gas and minerals. It is important that there be a better understanding of primary productivity and of the trophic relationships between the phytoplankton and dependent higher forms in the surrounding waters prior to extensive resource development, since phytoplankton species are often used as indicators of environmental changes resulting from resource development activities. In this report phytoplankton data from collections during 1984 and 1985 in northeastern Ungava Bay are tabulated. Fifty-four genera and 102 species were identified. The diatoms were the largest group in terms of the number of cells and species. Among them, centric diatoms had fewer species but a greater abundance of cells than the pennate diatoms. Chlorophytes, chrysophytes, blue-green algae, euglenoids and dinoflagellates occurred in lower numbers in terms of both cells and species. Seawater temperature ranged from 0.2 /sup 0/C. Salinity remained consistently between 3.0 and 3.2% except at one station. 1 ref., 1 fig.,

6431 **(FO/ABS—Fs97-13/0674) Phytoplankton data from western Baffin Bay and adjacent waters.** Hsiao, S.I.C.; Pinkewycz, N. (Department of Fisheries and Oceans, St-Anne-de-Bellevue, Quebec (Canada). Arctic Biological Station). 1987. 62p. (MICROLOG—88-02921). Dept. of Fisheries and Oceans, Scientific Information and Publications Branch, 200 Kent Street, 12th. Floor, Ottawa, Ont., Canada K1A 0E6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The data presented in this report are based on samples obtained through the Eastern Arctic Marine Environmental Studies Program (EAMES) which was carried out in response to proposed oil and gas exploration in the Canadian Eastern Arctic. Phytoplankton are the primary source of energy for all marine food chains. They are often used as indicators of environmental changes resulting from resource development activities. Phytoplankton samples were collected from 23 stations at depths of 1, 5, 20, 50, 100 and 200 m in eastern Jones Sound, eastern Lancaster Sound and western Baffin Bay during the summer and fall of 1979. These samples were quantitatively analyzed for species composition and abundance. In terms of number of species and cells, the diatoms comprised the largest group; green algae, chrysophytes, euglenoids and dinoflagellates occurred in lower numbers. 1 ref., 1 fig., 27 tabs.

6432 **(EC/Y/C—WNR86/87-CP(EP)11) Survey of benthic infauna at Beaufort Sea shorebase sites.** Sackmann, T. (Environment Canada, Yellowknife, Northwest Territories. Conservation and Protection). 1987. 46p. (MICROLOG—88-01157). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Beaufort Sea Shorebase Monitoring Program was initiated in 1982 to identify and monitor impacts of industrial developments on the north coast of Tuktoyaktuk Peninsula. As part of this program, benthic infauna samples were collected from Hutchison Bay, Tuktoyaktuk Harbour and McKinley Bay in 1982 and 1984. Collected organisms were enumerated and identified to species. Overall benthic faunal densities were highest in McKinley Bay and lowest in Tuktoyaktuk Harbour. The dominant species (calculated as percentages of total numbers of individual organisms) in Hutchison Bay were the bivalves Portlandia arctica and Macoma inconspicua in 1982 and 1984 respectively. For the 1982 and 1984 surveys of Tuktoyaktuk Harbour, the dominant species was the bivalve Cyrtodaria kurriana. In McKinley Bay, the dominant species were

the polychaete Aglaophamus neotenus in 1982 and worms from the family Cirratulidae in 1984. 7 figs., 5 tabs.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 5836, 5838, 6522, 6523

6433 (BCMEP—8709) Second report on chemical sensitivity of B.C. lakes to acidic inputs. Swain, L.G. (British Columbia Ministry of Environment and Parks, Victoria (Canada)). 1987. 38p. (MICROLOG—88-01353). British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, B.C., Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document provides information (pH, alkalinity, calcium, and sensitivity rating) for about 760 lakes sampled between 1977 and 1986, representing about 3.5% of the estimated 22,000 lakes in British Columbia. It provides locations where ten lakes with pH <6.0 have been found, and presents a generalized sensitivity map for the province. A distribution of lakes in the province by sensitivity indicator is presented which shows that about 20% of the lakes have high sensitivity to acidic inputs. Information is also provided on calculated relationships between total dissolved solids and several other characteristics. Relationships with a high level of confidence exist for calcium, inflection point alkalinity, and alkalinity to pH 4.5. 1 ref., 7 figs., 5 tabs.

6434 (DOE/FE/60972—T1) The role of sub-surface contaminant fate and transport models for RCRA land ban regulations. (Kuo and Associates, McLean, VA (USA)). Jul 1988. Contract AC01-86FE60972. 36p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002863/JAW.

This report includes an overview of the requirements and complexity of ground water and solute fate and transport models, and considers the predictive value of existing models for both aquifers and unsaturated soils. The material is presented so as to be of practical value to OFE in understanding and commenting on models used by EPA in its rulemakings and regulatory activities. Of specific interest is the EPACML model, which will be proposed later this year in the Federal Register. EPACML is EPA's new "back calculation model" (replacing EPASMOD) that will be used in the promulgation of RCRA land disposal regulations. The recommendations and conclusions are specifically intended to facilitate DOE comments in response to upcoming Federal Register announcements concerning EPACML and other relevant topics. The most important recommendations concern the need for EPACML to be employed on a site specific basis, and for EPA to demonstrate that the model has been field validated for a range of aquifer and solute types and conditions. 10 refs., 1 fig., 2 tabs.

6435 (EC/WTC—1988) Wastewater Technology Centre publications and presentations. (Environment Canada, Burlington, Ontario. Wastewater Technology Centre). [1988]. 40p. (CE—02032). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C.

The Wastewater Technology Centre is a Canadian federal institution located in Ontario, devoted to research and development activities in waste water management and characterization. Its priority concerns are in the areas of toxic chemicals, acid rain, energy related activities, northern development, and Canadian inland waters. This document presents a list of publications, including conference presentations, articles, and reports, from 1972 through 1985. Arrangement of entries is alphabetical within each publication year. 430 refs.

6436 (FO/H—654) Chemical characteristics of selected Cape Breton rivers, 1985. MacPhail, D.K.; Ashfield, D.; Farmer, G.J. (Department of Fisheries and Oceans, Halifax, Nova Scotia (Canada). Enhancement, Culture and Anadromous Fisheries Div.). 1987. 31p. (MICROLOG—88-01023). Canada Dept. of Fisheries and Oceans, Fisheries Development Branch, P.O. Box 550, Halifax, N.S., Canada B3J 2S7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Chemical characteristics of 14 rivers located in the Cape Breton East management zone were measured on two occasions during 1985. Only limited information on the characteristics of these rivers previously existed, and the results of this study can be examined to aid in determining their sensitivity to acidic precipitation. In this regard, a number of Atlantic coast rivers in mainland Nova Scotia have become more acidic during at least the past 30 years, in response to increased acid loading by precipitation, and native salmon populations in some have become extinct. Salmon have been angled in all except one of the 14 study rivers during the 1980-85 period, and total catch per year in these rivers has represented from 6 to 14% of the annual totals recorded for Nova Scotia. 7 refs., 15 figs., 14 tabs.

6437 (INA—ES48) The flux of suspended particulates, petroleum related hydrocarbons, trace metals and nutrients from the Mackenzie River during the winter season: a pilot study of the East Channel. Erickson, P.; Fowler, B. (Department of Indian and Northern Affairs, Ottawa, Ontario (Canada)). [1987]. 163p. (MICROLOG—88-01359). Indian and Northern Affairs Canada, Communications Branch, Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Water and suspended particulates were collected through the ice in the East Channel of the Mackenzie River about 30 km upstream from Kittigazuit Bay to estimate the winter dissolved and particulate fluxes of trace metals, nutrients and petroleum related hydrocarbons to the Beaufort Sea. Later, samples were also collected from the other major channels for comparison. Samples were collected using conventional discrete methods as well as a new in-situ pump. Results include the following. The Middle, Reindeer and East Channels account for all the winter flow through the Main Channel. Suspended particulate loads decrease as a function of current speed and distance downstream. Such particulates have a peak in size distribution between 2 and 6 μm. Organic C content of winter particulates was 4-8%. Winter chemical water properties on the basis of most major ions and nutrients are uniform across channel, with depth, and between channels. Concentrations of dissolved nonpolar and aromatic hydrocarbons were below detection limits for both sampling methods. Qualitatively, the particulate hydrocarbons were very similar; the primary source is terrestrial plant wax material. Chlorinated hydrocarbons were found at low levels in dissolved and particulates phases. Trace metal concentrations when compared to marine data indicate that the river is a source of Cu, Ni, V, Zn, Pb, and Cr. Nutrient level measurements show that nitrate levels are similar to those in shelf water, while phosphate concentrations are at least an order of magnitude lower than marine concentrations. 27 refs., 22 figs., 48 tabs.

6438 (NP—9770133) Dispersion of substances in the North Sea. Model results of the Deutsches Hydrographisches Institut and the Institut fuer Meereskunde der Universitaet Hamburg. (Deutsches Hydrographisches Inst. (DHI), Hamburg (Germany, F.R.); Hamburg Univ. (Germany, F.R.). Inst. fuer Meereskunde). 1987. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770133/JAW.

At the Institut fuer Meereskunde der Universitaet Hamburg and at the Deutsches Hydrographisches Institut numerical models have been developed which are particularly occupied with the question of how the substances runoff over the rivers spread in the North Sea by circulation and transport. The models have the same thing in common, that they only scrutinize one particular type of

substances. Only the dispersion of water-soluble substances are investigated on the assumption that the substances do not influence the current. The two models differ from one another in an important prerequisite: Whereas the DHI model computes the dispersion of the pollution using a mean circulation, the IfMH model examines the time-dependent circulation for a period from 1969 to 1982. Furthermore the numerical procedures, on which the models fundamentally base, are different.

6439 **(NP—9770138) Insulation and sealing of groundwater-polluting sources in the ground by construction of sealing walls and injection sols. Final report.** Hass, H.J.; Hitze, R. (Dynamit Nobel A.G., Troisdorf (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Mar 1987. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770138/JAW.

Sealing of contaminated sites, irrespective of the causes, is possible with the sealing materials described in the report by conventional building technique. The following individual materials were developed: An injection system for non-cohesive, permeable soils, consisting of solutions that bind in the pores of the soil to form a sealing gel stable towards chemicals. This gel-forming solution is dilute sodium silicate plus the alkali phosphate hardening agent DYNAGROUT PPN-A and the silane hardener DYNAGROUT PPN-B. Material for one-phase construction of a sealing wall containing up to 40% by weight of solid material and more. In spite of its high solid material content this cement-bound sealing mass can be used, thanks to the alkylalkoxy silanes DYNAGROUT DWR-C, as a suspension for subterraneous curtain construction. The silanes render the part of the surface which is not formed by cement hydrophobic, protect it against chemicals, and modify the flow properties of the capillary pores. Cement-free materials for two-phase sealing-wall construction. These materials contain up to 95% by weight of inert solid matter - silicates and clay. The binder is a mixture of dilute sodium silicate solution and the components DYNGROUT DWR-A and DWR-B, which become first liquid, during application, and then hard. Continuous measurements of the permeability coefficient k/sub f/ towards water and solutions of aggressive chemicals yielded values in the lower range of 10/sup -11/ metres sec/sup -1/. In the framework of large-scale experiments, the application of the method was successfully simulated.

6440 **(OMNR—1987) An assessment of the current impact and potential risks of acid deposition on small mouth bass populations in Ontario.** Matuszek, J.E. (Ontario Ministry of Natural Resources, Toronto (Canada)). 1987. Vp. (MICROLOG—88-00959). Ontario Ministry of Natural Resources. Fisheries Branch, Whitney Block, Room 2347, 99 Wellesley St. W., Toronto, Ont., Canada M7A 1W3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A set of 743 sampled smallmouth bass lakes were used to classify the known population of 2421 smallmouth bass lakes in Ontario by pH and alkalinity categories. Classification was performed by region, district and lake size class to reduce the effects of biases identified in the set of sampled lakes. Using data from previous field and laboratory studies, pH categories were defined to reflect the sensitivity of smallmouth bass poulations to low pH water: <5.0, extirpation certain; 5.0-<5.5, extirpation probable; 5.5-<6.0, extirpation possible. The percent of the known population of smallmouth bass lakes in Ontario in each pH category was estimated as: 0.2% with pH <5.0; 2.1% with 5.0≦H<5.5; and 6.9% with 5.5 ≦pH <6.0. Most (98.7%) of the estimated number of known smallmouth bass lakes with pH <6.0 are located in the Northeastern and Algonquin Regions. Alkalinity was used to classify lakes according to their sensitivity to acid loading. Sensitive smallmouth bass lakes (alkalinity <10 mg/l) located in areas receiving highly acidic deposition (>20 kg of wet sulphate per hectare per year) can experience pH depressions which may threaten inhabiting smallmouth bass populations. These lakes represent an estimated 47.3% of the known population of smallmouth bass lakes in Ontario. 32 refs., 5 figs., 3 tabs.

6441 **(UCRL—21008-Vol.5) Evaluation of military field-water quality: Volume 5, Infectious organisms of military concern associated with consumption: Assessment of health risks, and recommendations for establishing related standards.** Cooper, R.C.; Olivieri, A.W.; Danielson, R.E.; Badger, P.G.; Spear, R.C.; Selvin, S. (Lawrence Livermore National Lab., CA (USA)). Feb 1986. Contract W-7405-ENG-48. 273p. NTIS, PC A12/MF A01 - OSTI. Order Number DE89004402/JAW.

Considerable interest exists in establishing realistic standards for water quality as related to the transmission of infectious disease. The development of such standards is a complicated task that consciously, and frequently subconsciously, involves the concept of risk assessment. In the context of our study, risk assessment involves the relationship between the concentration of a pathogen in water and the likelihood of disease occurring in individuals who drink the water. A mathematical model was developed to take into account the variability of the pathogen concentration in water, and hence the dose, as well as the biological variability inherent in the dose-response relationship. An interactive computer program was developed that allows the user to select the organism of interest, the amount of water consumed, the treatment-alternative removal rate, the pathogen concentration, the dose-response model, and the number of susceptible individuals. Based on the users' selections, a computer-generated risk curve is produced. 67 refs., 27 figs., 109 tabs.

5206 Regulations

REFER ALSO TO CITATION(S) 6075, 6418, 6419

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 5804

5301 Social And Economic Studies

6442 **(LPCC—En57-27/1988-3) Implications of climate change for downhill skiing in Quebec.** (Lamothe and Periard Consultants in Climatology, Sainte-Foy, Quebec (Canada)). 1988. 36p. (In English and French). (MICROLOG—88-02892). Environment Canada, Document, Text and Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The main objective of this research was to evaluate the sensitivity of downhill skiing to eventual climatic change expected due to increasing levels of atmospheric CO/sub 2/ and other greenhouse gases. The first phase of the study consisted of identifying meteorological criteria relevant to the definition of skiable days. These criteria were subsequently applied to current climatic conditions; they were also applied to projected scenarios of climatic change in order to gauge the impacts of a warmer climate on the alpine ski industry. Preliminary socio-economic impact assessments were then made. Results show a decrease in the number of skiable days of 50% to 70% for southern Quebec; ski resorts equipped with snow-making devices would likely experience a smaller reduction in the number of skiable days ranging from 40% to 50%. Ski resorts in Eastern townships and the Laurentians would be unlikely to operate during the Christmas holidays without significant snowmaking facilities. Considering that a day of skiing brings approximately $34 (1981) per person into the Quebec economy, a major revenue loss would result. 3 figs., 3 tabs.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 6075

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 5940

6443 **(CONF-880423—1) Mouse endogenous retroviral long terminal repeat (LTR) elements and environmental carcinogenesis.** Yang, W.K.; Ch'ang, L-Y; Myer, F.E.; Yang, M.D.; Koh, C.K. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01 - OSTI. Order Number DE88015569/JAW.

From 40. biology symposium on transposable genetic elements; Gatlinburg, TN, USA (10 Apr 1988).

For the past several years, the working hypothesis of this laboratory has been that chromosomal retrovirus-related gene elements play important roles in gene-rearrangement and gene-activation events of carcinogenesis and mutagenesis induced by environmental agents. This working hypothesis is based on the concept of transposable genes as well as the recent understanding of retroviruses (RNA tumor viruses) in relation to the carcinogenesis problem. Activation of transposable gene elements has been discussed from the viewpoint of unprogrammed genomic changes in response to unanticipated genomic shocks. This view was used in considering the possibility of transposable gene elements involved in genetic changes of cancer formation in the animal. In this regard, this concept is similar to the perspectives of RNA tumor viruses, the oncogene-virogene hypothesis, and the provirus hypothesis because retroviruses replicate through DNA forms that carry long terminal repeat (LTR) sequences resembling the insertion sequences (or the IS elements) of prokaryotic transposons. The finding of oncogene myc activation in avian leukosis virus-induced leukemogenesis and proviral insertion in the mouse dilute locus mutation have also pointed to the functional similarity between retroviruses and transposable genes.

6444 **(DOE/ER/60649—2) [Development of gamma-emitting, receptor-binding radiotracers for imaging the brain and pancreas]: Progress report, October 1, 1987--October 1, 1988.** Reba, R.C. (George Washington Univ., Washington, DC (USA)). 1988. Contract FG05-88ER60649. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003250/JAW.

Our objectives as stated in the last removal submission were to synthesize a radioiodinated derivative of 4IQNB with a partition coefficient 10-fold less than that of 4IQNB, i.e., similar to that of QNB; to characterize the interaction of 4IQNB with the m-AChR isolated from pancreas; and to synthesize a high affinity analogue of QNB radiolabeled with F-18. Since the submission of the competitive renewal, we have prepared and submitted three manuscripts relating to studies on the muscarinic receptor. 2 tabs.

6445 **(DOE/EV/02472—1) Selection in linked systems: Final report, 1 December 1984--1 December 1987.** Lewontin, R.C. (Harvard Univ., Cambridge, MA (USA). Museum of Comparative Zoology). Nov 1988. Contract AC02-76EV02472. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004055/JAW.

This research was a theoretical study of the simultaneous operation of selection and recombination in populations. It was carried out both by mathematical and numerical methods in an attempt to get a general picture of the effect of natural selection on the genetic composition of a population when recombination is taken into account. 19 refs., 4 figs.

6446 **(DOE/FTR—9003591) [Cell division cycle and chromosomal DNA replication of higher plants and other eukaryotes, EMBO workshop on molecular basis of bacterial growth and division, Segovia, Spain, September 27--October 1, 1987]: Foreign trip report.** Van't Hof, J. (Brookhaven National Lab., Upton, NY (USA)). 20 Oct 1987. Contract AC02-76CH00016. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003591/JAW.

The details of DNA replication initiation in E. coli are gradually being understood at the enzymatic level. An in vitro assay system using the minimal 246 base origin has defined several separate steps so far. In vivo, the initiation process is complex because it involves the interaction of transcripts of genes in the origin region and specific DNaA binding boxes. The mechanism of replication termination is unknown. There is strong evidence for specific termination sequences but these too, are complicated by genes located in the terminus region. It is clear that sequences used as replication origins and termini are specific for a given species. Therefore, what is true for E. coli need not to be the rule for B. subtilis or Pseudomonas. Separation (cell division) and replication termination are tightly linked but the mechanisms responsible for this linkage remain a mystery even though many septation genes are identified. Likewise, the genes involved in plasmid or phage partitioning are known but how their products interact with the cell membrane to achieve segregation precision is still explained in hypothetical terms. Cell wall structure, a component of the septation phenomenon, is ripe for neutron diffraction studies. Until this structure is fully delineated, cell division in E. coli will not be understood.

6447 **(UCRL—99862) Identification, metabolism, genotoxicity, and modeling of mutagens produced in food by heating.** Felton, J.S.; Knize, M.G.; Shen, N.H.; Wu, R.; Taylor, R.T.; Fultz, E.; Turteltaub, K.W.; Vanderlaan, M.; Hwang, M.; Watkins, B.E. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 6p. (CONF-8810227—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003267/JAW.

From Nordic Food Mutagen Association meeting; Stockholm, Sweden (26 Oct 1988).

The cooking of foods derived from vertebrate muscle generates heterocyclic amines that are very potent bacterial mutagens. Many of these compounds have proven to be carcinogens following feeding to mice and rats. Our laboratory has isolated and compared the content of these mutagens in various cooked foods using standard analytical methods and specifically designed monoclonal antibodies. In addition, we have investigated mammalian short-term genetic effects in vitro and in vivo metabolism, and structure-activity relationships for these mutagens. Finally, we have investigated the mechanism of formation of these compounds during cooking. 6 refs., 1 tab.

5504 Genetics

REFER ALSO TO CITATION(S) 6443, 6446

5506 Medicine

REFER ALSO TO CITATION(S) 6311

6448 **(DOE/ER/60460—3) Harvard-MIT Research Program in short-lived radiopharmaceuticals: Technical progress report for the period March 15, 1986--August 1, 1988.** Adelstein, S.J.; Brownell, G.L. (Massachusetts Inst. of Tech., Cambridge (USA)). Sep 1988. Contract FG02-86ER60460. 76p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89002737/JAW.

This document contains progress reports on five related projects dealing with radiopharmaceuticals and nuclear medicine. Topics include studies in technetium chemistry, evaluation of technetium acetyacetonates as potential cerebral blood-flow agents, positron and radioiodine labeled brain perfusion agents, positron and gamma labeled branched-chain fatty acids as potential metabolic tracers, and labeling antibodies for radioimmunodiagnosis and radioimmunotherapy of cancer. (TEM)

6449 **(DOE/ER/60519—3) [New imaging systems in nuclear medicine]: Progress report.** Brownell, G.L. (Massachusetts General Hospital, Boston (USA)). [1988]. Contract FG02-87ER60519. 6p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003814/JAW.

The past year has seen gratifying results in the performance of PCR-I, the single ring analog coded positron tomograph, and in the development of the design of PCR-II, a cylindrical positron tomograph using two-dimensional analog coding. Analog coding provides high resolution imaging together with high count-rate capability. A computer system capable of handling the enormous amount of data generated by PCR-II is being developed. It will also be used to simulate the performance of the final system during its development. 2 figs.

6450 **(EUR—11059) Radiological mass screening within the Member States of the European Community. Regulations, practices, effectiveness.** Lochard, J. (ed.). (Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France); Commission of the European Communities, Luxembourg). 1987. 494p. (CONF-8512158—). Commission of the European Communities, Luxembourg.

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Proceedings of the seminar "Radiological mass screening within the Member States of the European Community" organized by the Commission of the European Community in collaboration with the Commissariat a l'Energie Atomique and the Centre d'etude sur l'Evaluation de la Protection dans le domaine Nucleaire, France, from 3 to 4 December 1985. Part I presents rapporteurs' papers which summarize the salient points concerning: the status of regulations and practices in the different countries, mass chest screening, mammography screening and infants' hip dysplasia screening. Part II presents all the technical papers contributed by the participants. The overall conclusions of the seminar pointed up the importance of assessing the effectiveness of screening or prevention practices more systematically. Although some aspects of the problems associated with radiological mass screening were only qualitatively addressed, the papers presented did explain why the use of certain medical practices must be justified. It is hoped that these proceedings will be useful to national experts and bodies in the planning of future public health programmes which, in the light of current practices, will have to take account of the medical, economic and social dimension of mass screening.

6451 (EUR—11059, pp 11-30) **Regulations and practices for systematic radiological screening within countries of the European Community.** Lefaure, C. (Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (France)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

To ensure the health protection of workers and the general public against the dangers of ionizing radiations, this presentation of the situation concerning the various types of mass radiological screening within the countries of the European Community is a brief description of the following: - the status of public regulations, - recommendations issued by medical authorities in various countries, - the actual practices of the medical profession, whether governed or not by the aforementioned regulations and official recommendations. Regulations, recommendations and/or systematic mass radiological screening practices concern mainly thre diseases: - tuberculosis, - cancer of the breast, - congenital dislocation of the hip.

6452 (EUR—11059, pp 31-42) **Cost-effectivenes and radiological risk associated with mass chest screening.** Stieve, F.E. (Gesellschaft fuer Strahlen und Umweltforschung mbH, Muenchen, Neuherberg (DE)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The decrease of pulmonary tuberculosis within the member States of the European Community necessitates adapting the measures for combating tuberculosis to the epidemiologically changed conditions of incidence, prevalence and mortality. On the basis of these considerations, it will be necessary to limit X-ray mass examinations selectively to those population groups showing an increased incidence and prevalence of infectious pulmonary tuberculosis. In X-ray examinations the general statement of optimization of radiation exposure must be considered because then radiation risk can be limited to a minimum.

6453 (EUR—11059, pp 43-50) **Population screening for breast cancer in the European Community.** Waard, F. de. (Rijksinstitut voor Volksgezondeid en Milieu Hygiene, Bilthoven (NL)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The possible benefits of early detection of breast cancer by means of mammography as a population-based program are evaluated. Before national programmes (or even European programme) of systematic population screening can be launched, a few basic decisions have to be taken. These apply to age groups to be screened: 50-64 at intake is being suggested here as a starter and time interval between screessing cycles: a two-year interval seems a reasonable compromise. Those countries having an interest in such programmes might find it useful to contact the project leaders of the ongoing programmes within the European Community (Nijmegen, Utrecht, Edinburg).

6454 (EUR—11059, pp 51-58) **Screening for congenital dislocation of the hip.** Fendel, H. (Muenchen Univ. (DE)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Screening for congenital dislocation of the hip (CDH) is the most important part of health protection in early infancy. Unfortunately, within the Member States of the European Community screening programs for CDH are, either non-existent or poorly organized. As a consequence of this deficiency, the late detection of deformed or luxated hips leads to an aggressive, harmful and expensive treatment. The present recommendations will help to improve the prevention of CDH and its consequences, and simultaneously lead to a considerable reduction of patient radiation exposure associated with X-ray examination of infant hips.

6455 (EUR—11059, pp 59-72) **Routine use of radiologic investigations WHO recommendations.** Racoveanu, N.T. (World Health Organization, Geneva (CH)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The concept guiding the WHO recommendations could be summarized as follows: radiologic investigations should be practised only when clinically relevant - which means on patients who will benefit from the resulting diagnosis and therapeutic decision based on the results of the investigation. This whole process results in a better health outcome - which is the most desired end point; routine radiologic investigations are unjustified unless the high prevalence of specific clinically silent disease demands such a measure. Even in these circumstances, all possible efforts are justified to define better epidemiological and clinical high yield criteria, which constitute a rational way to increase the predictive value of the investigation. Pursuing the concept expressed above, WHO has added the idea of use of alternative imaging technology in circumstances where the benefit/risk and benefit/cost ratio are favorable to the given alternative (ultrasound, CT scanner, etc). All these concepts, applied particularly to the rational use of diagnostic imaging to paediatric patients, constitute the end result of the Study Group Meeting held from 18 to 25 November 1985 at WHO.

6456 (EUR—11059, pp 73-92) **Concepts of optimization and justification consequences for radiological mass screening.** Carmichael, J.H.E. 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Any examination, be it a mass survey or otherwise, is capable of being analyzed under the headings - Justification, Optimization and Attention to Dose Reduction. In respect of mass survey, justification must be very clear and must be a result of careful analysis of all the factors and there must be a clear cut increase in the cure rate, increase in length of life, or increase in quality of life. Unless this can be shown clearly, the survey should not be carried out. If it can be shown clearly, then it is up to a government authority to look at the financial and social implications and make a decision.

6457 (EUR—11059, pp 93-102) **Practice and regulations of radiological chest screening in Denmark.** Berg, O.; Hjardemaal, O. (National Inst. of Radiation Hygiene, Copenhagen (DK)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Mass chest screening by means of photofluorography was initiated in Denmark in the first years after World War II. The number of persons examined yearly increased continually to a maximum of 900.000 (a fourth of the whole population) in 1972. At this time efforts were made to reduce mass chest screening to small specific risk groups in the population, resulting in a gradual reduction until 1983 when mass chest screening was totally abolished. The technical provisions for photofluorographic X-ray equipment and for X-ray rooms as well as the provisions for the inspection of the installations are stated. Finally results of surveys regarding exposure measurements on photofluorografic equipment are shown and a maximum permissible level of the exposure measured at the entrance plane of the equipment is recommended.

6458 (EUR—11059, pp 103-110) **Practices and regulations for radiological mass screening in the Federal Republic of Germany.** Hinz, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (DE). Inst. fuer Radiation Hygiene). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Since approximately 5 years ago, a process of investigation is underway in the individual states of the Federal Republic for determining the validity of current practices and regulations for chest X-ray mass screenings. There is a trend towards change from general X-ray mass screenings to that of selected risk groups as a result of a decrease in tubercular disease cases. A generally accepted definition of "risk groups" has not as yet been defined, so that various procedures are still being used in the individual federal states. It is commonly agreed, however, that the frequency and the extent of radiological mass screenings for the detection of tubercular disease have to be in direct correlation with the respective epidemiological situation. The International Commission on Radiological Protection has repeatedly emphasized the necessity of a regular review of chest X-ray mass screening procedures and their adaptation to respective epidemiological conditions. This demand is not only made for reasons of cost efficiency but is primarily governed by the desire to keep the radiation exposure of individuals and the general population as low as reasonably achievable.

6459 (EUR—11059, pp 111-128) **Regulation and practice of X-ray screening in France.** Lefaure, C.; Bouvet, E.; Weill, C. (Centre d'Etude sur l'Evaluation de la Protection dans le domaine Nucleaire (CEPN), 92 - Fontenay-aux-Roses (FR); Ministere des Affaires Sociales et de la Solidarite, 75 - Paris (FR)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

To ensure the health protection of workers and the general public against the dangers of ionizing radiations the regulation and practice of radiological screening in France may be summed up by: - the presistance of an excessive and probably unjustified number of mass radiological examinations for screening against tuberculosis, in spite of very strict regulations. Decentralization should accelerate restriction. - Wide practice of screening against congenital hip dysplasia in contrast with the lack of regulations. - On the other hand, screening of breast cancer by mammography is not widely practiced, and is subject neither to regulations nor official recommendation. - Finally, the non-rationalized practice of mass chest X-rays on entry to hospital warrants closer study and evaluation.

6460 (EUR—11059, pp 129-146) **Practice and regulations of radiological mass screening in Italy.** Indovina, P.L.; Romagnoli, S.; Paganini Fioratti, M. (Istituto Superior di Sanita, Rome (IT). Lab. di Fisica; Ente Nazionale per l'Energia Elettrica, Rome (IT)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

In order to show the extent of the contribution made by mass radiological screenings to the overall exposure of the population, the essential results of a study made by the Italian Society of Radiological and Nuclear Medicine in 1980 are reported. The regulations in Force in Italy on the basis of which, radiographic or radioscopic examinations are required, are listed. As an indication of the difficulties which encounters the process of improving the utilization of ionizing radiation in mass radiological screenings, some passages contained in two statements expressed by the Higher Health Council are reported.

6461 (EUR—11059, pp 147-150) **Radiological mass screening in the Irish Republic.** O'Donnell, B. (Medical Officer of Health, Dublin (IE)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Radiological mass screening for tuberculosis, mammography screening and congenital dislocation of hip screening used in the Irish Republic are evaluated. Routine mammography has never been used in the Irish Republic. Early fears were expressed about the risks of radiation with repeated mammography but with better radiographic techniques this risk is now regarded as being very small.

6462 (EUR—11059, pp 163-204) **Cost-effectiveness and risk associated with radiological chest screening programmes illustrated at the results of mass-screening in Bavaria/Federal Republic of Germany.** Schmidt, T.; Stieve, F.E. (Center of Radiology, Klinikum, Nuernberg (DE); Gesellschaft fuer Strahlen und Umweltforschung m.b.H. Muenchen, Neuherberg (DE)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The decrease of pulmonary tuberculosis in the Federal Republic necessitates adapting the measures for combating tuberculosis to the epidemiologically changed conditions of incidence, prevalence and mortality. On the basis of these considerations, it will be necessary to limit X-ray mass examinations selectively to those population groups and districts showing an increased incidence and prevalence of infectious pulmonary tuberculosis. In all the other districts the diagnosis of the diseases should be concentrated on the focus of infection, in order to stop the infection-chain and to support a further decrease effectively. In X-ray examinations the general statement of optimization of radiation exposure, must be considered, because then radiation risk can be limited to a minimum.

6463 (EUR—11059, pp 205-232) **Cost-effectiveness and radiological risk from mass tuberculosis X-ray screening in France.** Le Gales, C.; Lefaure, C.; Lochard, J. (Institut National de la Sante et de la Recherche Medicale (INSERM), 92 - Fontenay-aux-Roses (FR); Centre d'Etude sur l'Evaluation de la Protection dans le Domaine Nucleaire, 92 - Fontenay-aux-Roses (FR)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

This paper provides informations and data on the effectiveness, costs, and radiological risk associated with the routine chest X-ray screening for pulmonary tuberculosis in the French population in 1982. Effectiveness is estimated from the analysis of 18 french studies performed during the 1970-1983 period. Screening costs have been evaluated from specific data gathered in representative institutions involved in X-ray screening. As for radiation doses to the population, they come from measurements performed at 17 X-ray units for radiography, photofluorography and fluoroscopy.

6464 (EUR—11059, pp 233-244) **Radiological tracking down of pulmonary tuberculosis in France; investigation concerning 984 declared cases.** Hirsch, A.; Le Gales, C.; Lefaure, C.; Vallier, F. (Hopital Saint-Louis, 75 - Paris (FR); Institut National de la Sante et de la Recherche Medicale (INSERM), 92 -Fontenay-aux-Roses (FR)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

To ensure the health protection of workers and general public against the dangers of ionizing radiations, the purpose of this study is to: describe the populations with a pulmonary tuberculosis risk factor, determine the percentage of cases observed by systematic tracking down in a declared tubercular population, compare the populations effectively covered by radiological tracking down to the populations with a risk factor, compare the medical characteristics (symptomatology and the bacteriological expectoration results) of pulmonary tuberculosis cases discovered by systematic tracking down to the characteristics of cases discovered during hospital consultations or by personal doctors.

6465 (EUR—11059, pp 245-250) **Mass chest radiography in Greece.** Papavasiliou, C. (Athens Univ. (GR)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

In Greece, the incidence of tuberculosis has considerably declined, however it is somewhat higher than in Western European countries Other pulmonary diseases are not also of very high incidence. Although the decline of tuberculosis is partly due to mass chest radiography, it is believed that the method is now being overused and considerations for cost and hazards should be taken into consideration Military officials, however, strongly recommended miniature mass chest radiography to army recruits for the coming several years.

6466 (EUR—11059, pp 251-266) **X-ray chest mass screening for pulmonary tuberculosis in Friuli Giulia Region, Italy.** Barbina, V.; Contento, G.; Padovani, R.; Pitzalis, G.; Nigris, C. 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

This paper reports up-to-date information and data on frequency, effectiveness, cost and radiation risks of chest X-ray screening in the "Regione Autonoma Friuli Venezia Giulia" (FVG), North-East Italy, population 1,300.000. If compared to other italian areas, FVG May be considered as representative of a mixed-economy typical situation, for it includes rural, industrial and touristic areas more or less uniformly spread over. In collecting and processing epidemiologic, demographic and dosimetric data on a limited area as FVG there is one advantage, namely the opportunity of having everything at hand-- the data and the persons who collected them, with the possibility of on-line and constant checks. Hopefully, this should result in a good level of accuracy of the statistical estimates, which may prove useful samples for more wide studies carried out by official national institutes.

6467 (EUR—11059, pp 277-280) **Mass chest screening in Luxembourg.** Kayser, P. 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

6468 (EUR—11059, pp 361-366) **Cost-effectiveness and radiation risk of breast cancer screening.** Rombach, J.J. (Rijksuniversiteit Utrecht (NL)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Cost-effectiveness analysis is the determination of the most efficient or productive use of limited resources to gain the most benefit of medical care. Then breast cancer screening is justified if the following conditions are met: the disease constitutes an important public health problem (morbidity in the Netherlands more than 7000/year); the natural history is reasonably known; the preclinical phase is detectable by mammography; the procedure of detection is acceptable (estimation of risk associated); the therapy protocols are agreed upon; the follow up is realized, the screening examinations are repeated.

6469 (EUR—11059, pp 343-360) **Cost-effectiveness and radiological risk associated with mammography screening in Italy.** Toma, S.; Pino, G.; Brighetti, S. (Genoa Univ. (IT)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The available evidence, including biological evidence, supports the notion of a non-linear relationship between dosage and effect, especially when comparing small and average cumulative dosage. There is, however, no specific experimental evidence to demonstrate this. Nor is there any evidence of risk from mammography. Nevertheless, this type of examination in young asymptomatic women should be evaluated in terms of risk/benefit, given the essential role played by latency time in tumour development. The cost-effectiveness of mass screening must be evaluated by simulation of models before the screening itself is begun. The use of mathematical methods in the evaluation of the costs and the benefits is, today, necessary to attain to optimizing decisions, for improving social and medical aspects of a mass screening program. This approach needs of tools as: Markov analysis, Queues theory, Montecarlo method, Decision theory, Linear programming ecc., but its advantages are manifest. It permits to choose the best acts for our needs, satisfying at the same time medical and financial aspects.

6470 (EUR—11059, pp 311-342) **Evaluation of costs and benefits of mammography screening for breast cancer in the context of french resources.** Bouhnik, H.; Renaud-Salis, J.L.; Maccia, C. (Institut Gustave Roussy, 94 - Villejuif (FR); Fondation Bergonie, 33 - Bordeaux (FR); Centre d'Etudes sur l'Evaluation de la Protection dans le domaine nucleaire, 92 -Fontenay-aux-Roses (FR)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The current evidences and assumptions about the effectiveness, the costs, and the benefits of mammography as a breast cancer screening test, are presented. The feasibility of such a program in France is evaluated taking into account the existent facilities and their capacities to meet an increased demand. The radiation hazards and the dose per exposure according to the type of detector used

are evaluated. In France, the average dose delivered in the mid-breast for one exposure mammography in 1978 was 0.265 cGy and was 0.110 cGy in 1984.

6471 (EUR—11059, pp 303-311) **Alterations in age distribution of breast cancer patients over the last 20 years.** Paterok, E.M. (Erlangen-Nuernberg Univ., Erlangen (DE)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The age distribution of breast cancer patients in three periods of time is studied. It should be noted, that the highest incidence in the year 1983 was seen in the 40 til 49 year old women. Evidently the age distribution of breast cancer patients is shifting. Malignant tumors of the female breast are diagnosed now at a younger age. We conclude that this phenomenon in part can be explained by the essentially improved screening methods of the breast over the last 20 years and population counseling in general.

6472 (EUR—11059, pp 303-310) **Radiation exposure and risk from mammography.** Sabel, M. (Erlangen-Nuernberg Univ., Erlangen (DE). Klinik fuer Franenheilkunde mit Poliklinik und Hebammenschule). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Using the published data on radiation exposure, radiation risk and effectiveness of mammographic screening one can try to compare risk and benefit. Several authors have done this with different assumptions and different results in detail. But there seems to be general agreement that radiation risk is not significant, if screening starts at age 50, using dedicated radiographic equipment and a film-screen system of high speed.

6473 (EUR—11059, pp 281-288) **Breast cancer screening.** Vandenbroucke, A. (Louvain Univ. (BE). Centre des Tumeurs). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Many studies have shown that breast cancer screening is able to reduce breast cancer mortality. Mammography is considered as the most effective method for breast cancer screening. An alternative method to mammographic screening is the clinical examination of the breasts. The validity of screening tests is judged by their sensitivity and their specificity. In conclusion of the present study, it seems reasonable to wait for the conclusions of the randomized controlled studies currently going on in the U.K. and in Canada to evaluate the sensitivity, the specificity and the predictive value of the clinical examination of the breast before making a decision about the method of screening to be recommended for the population at large.

6474 (EUR—11059, pp 267-276) **Notes on a local study on effectiveness and risk of x-ray mass chest screening.** Barbina, V.; Leonardi, M. 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

This contribution consists of some special remarks on the results of a local investigation on effectiveness and radiological risk of mass chest screening carried out in Friuli Venezia Giulia, an area of North-East Italy limited by well defined geographical and administrative borders. Population are about 1.300.000 ten percent of which are undergoing x-ray chest screening each year. The problem of x-ray doses is considered. Therefore, in the situation described in the study, the problem of cost-effectiveness should be given higher priority over the problem of radiological risk. The high stabilizing action of mass chest screening against the spreading of the pulmonary tuberculosis is demonstrated.

6475 (EUR—11059, pp 159-160) **Practices and regulations of radiological mass screening in the United Kingdom.** Abrams, M.E. (Department of Health and Social Security, London (GB)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The only radiological mass screening undertaken in the UK was the mass miniature radiography service for detection of tuberculosis by chest x-ray. Mass miniature radiographic (MMR) units were set up when tuberculosis was a common illness. However, by 1969 the detection rate of tuberculosis was so low that it was no longer cost-effective as a preventive health measure. In the last decade there has also been an increased awareness that people should only be exposed to radiation for medical purposes if it is judged to be clinically desirable. For some years, therefore, the Department's policy has been to discourage self-referral to these units and to advise people to consult their doctor should they be concerned about symptoms.

6476 (EUR—11059, pp 151-158) **Radiological mass screening in the Netherlands.** Pater, J. de. (Ministry of Housing, Physical Planning and Environmental Management, Rijsvijk (NL)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

In the Netherlands mass x-ray examination of the thoracic organs has virtually ceased, but the Dutch government has not yet decided whether to introduce mammographic mass screening throughout the country. The risk attached to radiation is minimal. With proper techniques and modern equipment the organ is exposed to a dose of 0.1 rad per photograph. The final decision therefore ultimately depends on the list of priorities established for health care.

6477 (EUR—11059, pp 421-436) **Cost-effectiveness and risk associated with infants' hip dysplasia screening in France.** Maccia, C.; Lefaure, C.; Corlobe, F. (Centre d'Etude sur l'evaluation de la Protection dans le domaine Nucleaire, 92 - Fontenay-aux-Roses (FR); Hopital Saint-Louis, 75 - Paris (FR)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Right now a common attitude in France is the routine prescription of a pelvic X-ray during the third and fourth months of life. Being accepted by most of the medical staff that the interpretation of the pelvic X-ray in the two first months of life is difficult and hazardous. In order to evaluate the cost-effectiveness an epidemiological study would be necessary. It would have to determine: - the incidence of CHD both for general population and high risk groups, - the efficiency of the clinical screening at birth, - the sensibility (false positive) and specificity (false negative) of the radiological mass screening during the fourth month of life, - the cost of the treatment of those true and false positive. But each suspicion of congenital hip dysplasia having to be treated it would be possible afterwards to evaluate those false positive. If a systematic X-ray policy was to be decided it would require a well trained staff in order to avoid over or under diagnosis and needless irradiation.

6478 (EUR—11059, pp 415-420) **Congenital hip dislocation: radiological screening or diagnosis.** Kalifa, G.; Faure, C. (Hopital Saint-Vincent-de-Paul, 75 - Paris (FR)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Congenital dislocation of the hip must be detected at birth by a good clinical examination. Radiological examination should be reserved to doubtful clinical examination, to some groups with familial history, abnormal abduction, breech presentation, wryneck,

genu recurvatum, brachial plexus palsy. This radiological examination should be made during the fourth month, with very precise technique and should be interpreted very carefully. The radiation risks must be minimized by using a strict collimation of the beam to the pelvis, a high kilovoltage (60 kv), fast films, rare earth screens, image intensifier fluoroscopy photograph, omission of the grid, gonadal shielding. The gonadal dose delivered by this radiological examination remains low varying for 0.002 mGy to 0.005 mGy with gonadal shielding and 0.05 mGy in girls with insecure or absent gonadal shielding.

6479 (EUR—11059, pp 395-414) **Limitations of cost-benefit evaluation of non-systematic radiological screening of congenital dislocatable or dislocated hip in Germany.** Weidtman, V.; Heereman, B. von; Herrmann, F. (Koeln Univ. (DE)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

Cost-benefit analysis in the field of screening procedures not only comprise economic aspects, but they also require a thorough analysis of possible health risks. Many publications on this topic during the past years have proven that even in such a well investigated problem, like the dislocated or dislocatable hip, this can lead to difficulties. Up to this day it remains questionable whether the quality of the assessment can be improved considerably. Three strategies of CDH-screening with different degrees of radiation load, sensitivity, specificity are presented. Speculations about radiation exposure and cost benefit considerations are misleading as long as they are not supported by reliable data from carefully designed field studies, reflecting the reality after a screening strategy has been introduced into daily routine.

6480 (EUR—11059, pp 381-394) **Futility of the roentgen-screening of infants for congenital dislocation of the hip.** Fendel, H.; Fuhrmann, G.; Schneider, K. (Muenchen Univ. (DE)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

It should be emphasized, that the X-ray examination of the infant hips should always be performed with gonadal shielding and with radiation minimization techniques. Roentgen examinations can be made with a number of optimizing techniques, that can justify its use for a selected number of individual cases, before the age of 4 - 6 months using ANDREN-VON ROSEN technique, after that age a good standard position. X-ray screening in the 4th - 6th month of life, however, would imply a high risk of technically suboptimal examinations with excessive radiation exposure. Consequently, it is unnecessary to delve in risk-benefit and cost-benefit considerations for a general X-ray screening, because it is basically unacceptable.

6481 (EUR—11059, pp 367-380) **Mammography and mammographic screening in the United Kingdom: practices, regulations and radiation dosimetry.** Fitzgerald, M. (Saint Bartholomew's Hospital, London (UK)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The practice of mammography and mammographic screening in the UK can be gauged from results of two surveys that were conducted during 1976 to 1977 and in 1980. The first was commissioned by the Hospital physicists association because of concern at the large inter-Hospital variations in patient dose and image quality that had been observed in one local survey. The second study involved identifying all the mammography centres in the UK. The results showed that there were large differences in radiographic practice at different centres. The overall dose and image score results are summarized. The relatively low risk to the breast is a consequence partly of the low dose mammographic techniques that can now be practised, and partly of the acceptance of mean breast dose, which may be an order of magnitude less than the surface dose, as the measure of risk.

6482 (EUR—11059, pp 437-450) **Cost-effectiveness and risk associated with infants'hip radiological screening in Italy.** Pini, M.; Perale, R. (Trieste Univ. (IT); Padua Univ. (IT)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

A mass radiologic screening program for the detection of congenital dislocation of the hip (CDH) in Italy, even in high incidence zones, does not appear appropriate despite the favorable cost effectiveness ratio reported for the x-ray examination of the hip. This low cost seems in any case superfluous in view of the excellent results achieved with a clinical screening program. Nevertheless, the advantages of computerized tomography (CT) in the examination of the displastic hip have recently been stressed. CT was performed in two patients, the diagnostic results seem encouraging and deserve further discussion. The gonadal doses were calculated.

6483 (EUR—11059, pp 461-494) **Screening for congenital dislocation of the hip in the newborn: the role of clinical, ultrasonographic and radiographic examination.** Dunn, P.M. (Bristol Univ. (UK)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

The advantages and disadvantages of the various possible methods of screening for congenital dislocation of the hip (CDH), radiological, sonographic and clinical, are considered. Radiological screening has the advantage that it results in an objective record. However it is relatively expensive, exposes the infant to radiation and especially in the early months of life. Sonographic screening has the advantage of not exposing the infant to radiation. Its particular value is that it provides the means to make real-time dynamic studies of the unstable hip. However it also requires the availability of quite expensive apparatus. Clinical screening is not only potentially the most effective method of screening, it is also the least expensive and has clear logistic advantages.

6484 (EUR—11059, pp 451-460) **Annotations on cost-effectiveness and risk associated with infants'hip radiological screening in the Netherlands.** Kramer, P. (Rijksuniversiteit Utrecht (NL)). 1987. Commission of the European Communities, Luxembourg. (CONF-8512158—).

From Seminar on radiological mass screening within the member states of the European Community; Luxembourg, Luxembourg (3 Dec 1985).

In the Netherlands there is never made a good cost-benefit analysis of the radiological screening of the infant hip abnormalities. Although we still not know the exact costs of the treatment of a child with congenital dislocation of the hip and considering the risks of the radiation we think that if there is a clinical sign for dislocatable hip or congenital dislocation of the hip it is necessary and allowed to make a radiograph of the pelvis in the newborn period and early years of life. We think that in the Netherlands it is not necessary to examine radiologically all the children of 3 months of age. But we do not exactly know how many children are coming to late for functional treatment. Ultrasound will almost certain replace X-ray examination. It is necessary to make further research into this subject.

6485 (JINR-D—9-87-105-Vol.2, pp 155-162) **Six-cabin clinic-physical complex of the laboratory of nuclear research of JINR for radiotherapy by heavy nuclear particles.** Dzhelepov, V.P.; Savchenko, O.V.; Astrakhan, B.V.; Ruderman, A.I. (Joint Inst. for Nuclear Research, Dubna (USSR); Akademiya Meditsinskikh Nauk SSSR, Moscow. Onkologicheskij Nauchnyj Tsentr). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780034/JAW. (CONF-8610271—).

From 10. All-Union conference on charged-particle accelerators; Dubna, USSR (21 Oct 1986).

Advantages of conducting clinical tests using the charged particle accelerators under operation or reconstruction are described. The layout of the first stage of medical beam switchyard

and location of six procedure cabins of the JINR medical-physical complex is presented. Three cabins are intended for proton therapy, the fourth cabin is for therapy by negative π-mesons, the fifth cabin is for neutron therapy. The sixth cabin is designed for gamma-facility location. As a result of conducting a work program practical recommendations concerning the choice of the most optimal variants of methods for oncology patient treatment by beams of protons, negative π-mesons and high-energy neutrons and concerning the further development of methods of radiotherapy using these beams. 12 refs.; 1 fig.; 1 tab.

5507 Microbiology

REFER ALSO TO CITATION(S) 6441, 6445

6486 **(ORNL/TM—10670) PLOTSAM: A simulation of systematic and random sampling.** Franklin, R.L.A.; Gardner, R.H.; Dale, V.H.; White, P.S. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 62p. NTIS, PC A04/MF A01. Order Number DE89004249/JAW.

PLOTSAM the computer program, that simulates sampling of organisms or environmental conditions, is described. The program has three major components: a specification of the location and the statistical characteristics of the organisms or conditions, a sampling, and a computation of statistical tests. With PLOTSAM, the location of the organisms or site conditions can be specified as a systematic or bivariate normal distribution, and the attributes can have a normal, lognormal, uniform, or triangular distribution. Furthermore, sampling can be performed by placing quadrats randomly or systematically along one or more transects in a square plot. Descriptive statistics of the complete and sampled data sets can be examined. Then statistical tests can be performed to compare the complete and sampled data sets. The advantage of using a simulation for sampling is that the sampled information can be compared to the complete population and that the accuracy and precision of the sampling methods thus can be tested. Knowledge of the adequacy of the sampling regime is otherwise difficult to obtain in many ecological studies because the populations are frequently so large that collecting all of the measurements is not feasible. Using PLOTSAM, a test is performed to examine the effects on the estimates of the mean and the variance when the number of samples is increased and different distributions of the attribute are simulated. This test was parameterized with values obtained from a sampling of available soil nitrogen with ion exchange resin bags. The simulations suggest that the increase in accuracy associated with an increase in sample number is related to the skewness and kurtosis of the true population. 16 refs., 8 figs., 7 tabs.

5520 Public Health

REFER ALSO TO CITATION(S) 6441, 6529

5530 Agriculture And Food Technology

6487 **(OH/RD—87-148-K) Effects of growth regulators on the number and length of internodes in sprouts formed on trimmed silver maple.** Arron, G.P. (Ontario Hydro Research Div., Toronto (Canada)). 1987. Vp. (MICROLOG—88-00154). Ontario Hydro Research Division, Editorial Section, 800 Kipling Ave., Toronto, Ont., Canada M8Z 5S4; $10.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The trimming of problem trees under distribution lines on city streets and in rural areas is a major problem and expense of electric utilities. In recent years, a group of new growth regulators has been introduced which is effective in controlling the growth of trees without producing noticeable injury symptoms. Member of this group, MBR 18337, PP 333 and EL-500, have been applied to trees by trunk injection, a method which offers some advantages over other application methods such as foliar spray and soil injection. This study investigated the effects of trunk injection of the aforementioned regulators on sprout growth in silver maple seedlings grown in the greenhouse, and of PP 333 and EL-500 on sprout growth in silver maple trees grown in the field. In both seedlings and trees there were significant reductions in sprout growth. The reduction in sprout growth observed after application of PP 333 and EL-500 was the result of an inhibition of internode elongation and a reduction in the number of internodes per sprout. Application of MBR 18337 to seedlings resulted in an inhibition of internode elongation but a reduction in the number of internodes per sprout was not observed (at the application rates used). 35 refs., 7 figs.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 6493

6488 **(CONF-8810209—7) Nonrandom distribution of mutations induced by x rays in a plasmid target in human cells.** Mitra, S.; Sikpi, M.O.; Preston, R.J.; Waters, L.C. (Oak Ridge National Lab., TN (USA)). 14 Oct 1988. Contract AC05-84OR21400. 23p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003104/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

The supF gene of E. coli incorporated in the recombinant human plasmids pZ189 and pZ190 was used as a target for mutagenesis induced by x rays and N-methyl-N-nitrosourea (MNU). Human lymphoblastoid cells were transfected with the mutagen-treated plasmid and the progeny molecules carrying mutations in the target sequence were isolated and sequenced. An analysis of these mutations indicates the following: (1) Plasmid DNA treated with 40 Gy x ray yielded 2.3 times more mutants than the unirradiated control. In contrast, MNU treatment of the target gene fragment alone yielded 15 to 80-fold more mutants than the control. (2) Multiple point mutations were more common in both control and x-irradiated plasmids than in MNU-treated DNA. (3) A significant fraction of mutants in all cases had deletions of up to more than a hundred nucleotides that included part of the target sequence. (4) Most of the point mutations in all cases involved G{center←dot}C pairs and involved both transitions and transversions. (5) Single base mutations were nonrandom; G_{123}, the middle G of a GGG sequence and C_{109} of the coding strand stood out as hot spots for both MNU and x ray-treated DNA but not in the control. On the other hand, mutations in another run of G's (G_{102}-G_{105}) were observed in control DNA but not in x-irradiated samples. (6) C's of 5'-TC doublets in the coding but not in the noncoding strand were the most common targets for change in x-irradiated DNA. This strand bias was not observed in the control DNA. 26 refs., 2 figs., 1 tab.

6489 **(DOE/ER/60540—1) [Mechanisms involved in the induction of radiation transformation in vitro]: Technical progress report.** Little, J.B. (Harvard Univ., Boston, MA (USA). School of Public Health). 1986. Contract FG02-87ER60540. 3p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003076/JAW.

This report describes recent advances in the study of radiation on biological materials. Topics include the relative biological effectiveness of fast neutrons, the molecular structure of mutations induced by high LET radiation, the cellular localization of Auger-emitting radionuclides, and the induced processes in neutron-irradiated human cells. 11 refs., 1 tab. (TEM)

6490 **(DOE/ER/60540—2) [Factors influencing transformation and mutagenesis in vitro by high LET radiation]: Technical progress report.** Little, J.B. (Harvard Univ., Boston, MA (USA). School of Public Health). 1988. Contract FG02-87ER60540. 6p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003075/JAW.

This report describes the recent advances in the study of radiation on biological materials. Topics include the relative biological effectiveness of fast neutrons, the molecular structure of muta-

tions induced by high LET radiation, the cellular localization of Auger-emitting radionuclides, and the induced processes in neutron-irradiated human cells. 4 refs. (TEM)

6491 **(DOE/FTR—9003589) [Attend meetings on NCT and Photon Activiation Theory (PAT) and visits to Harwell and Rutherford Laboratories, England and Scotland, July 16--23, 1987]: Foreign trip report.** Fairchild, R.G. (Brookhaven National Lab., Upton, NY (USA)). 17 Aug 1987. Contract AC02-76CH00016. 5p. NTIS, PC A03. Order Number DE89003589/JAW.

At Harwell, experiments at the DIDO and PLUTO reactors are directed toward development of a "pure" epithermal neutron beam for clinical application of NCT. Their experience with Fe filtered 24 keV beams, and Al,S and Ar filtered beams, as well as the radiobiological and dosimetric techniques used in evaluating these beams, are of great interest to us as we evaluate similar filters at the Brookhaven Medical Research Reactor (BMRR). At the Auger Emitter conference, many of those involved in the theoretical evaluation of Auger Cascades, as well as some of those groups engaged in systemic administration of Auger emitters for therapy, presented their recent works. These efforts are of significance to out PAT program, as we try to evaluate the radiobiological and clinical significance of Auger Cascade stimulated by our Sm-145 brachytherapy sources. The discussion meeting on BNCT was valuable in that it presented the opportunity to catch up on the various European efforts. The participants were extremely interested in the proposed clinical trails in the US in the near future, as the outcome of such trials would to a significant extent determine the long-term prospects for development of NCT in Europe and England. The International Congress of Radiation Research was a particularly interesting meeting, as much of the work was aimed at developing concepts and techniques for radiation therapy. The highlight of the meeting was (for me) a survey paper on NCT delivered by Dr. Yu.S. Ryabukhin, who is head of the NCT program in the USSR.

6492 **(ENEA-RT-PAS—88-3) Body activity measurements of Cs 137 and Cs 134 in male adult population resident in different Italian areas.** Melandri, C.; Castellani, C.M.; Tarroni, G.; Formignani, M.; Rampa, E.; Santori, G.; Di Pietro, S. (ENEA, Bologna (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 27p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704430/JAW.

Results of internal contamination measurements of Cs-137 and Cs-134 performed by means of the ENEA Whole Body Counters in Bologna and in Casaccia following the accident at nuclear reactor in Chernobyl are presented. Trends of Cs-137 and Cs-134 internal body burden in adult men resident in Bologna and Rome and evaluation of the committed dose equivalents due in ingestion up to 30.6.1987 are given. Finally mean values of internal activity measured in groups of the same sex resident in various Italian regions are also reported.

6493 **(INIS-mf—11858) Postnatal development and neoplastic disease pattern in NMRI-mice after combined treatment with ethylnitrosourea and X-irradiation on different days of the fetal period.** Wiggenhauser, A. (Muenchen Univ. (Germany, F.R.). Tieraerztliche Fakultaet). 27 Feb 1987. 186p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756105/JAW.

Mice were X-irradiated on either day 14, 15, or 16 of gestation with 1,0 Gy. This did not result in an increased tumor frequency in offspring until 12 months. Mice treated parallelly with ENU (45 mg/kg) on the same gestation days developed a significantly increased tumor frequency of the lungs and the liver in all treated groups, and of the ovaries after treatment on day 15 of gestation. This experiment was the first to show that ENU-treatment resulted in hemangiosarcomas of the subcutis at a low incidence. After combined treatment in the sequence X+ENU and an interval of 4 hours, increased tumor frequency was observed only in the offspring treated on gestation day 16. The diagnoses liver tumors and hemangiosarcomas were significantly augmented after X+ENU-treatment on day 15 and 16 and day 14 and 16, respectively. In the reverse sequence (ENU+X) the total tumor outcome was not significantly altered in comparison with the effects of ENU alone. However, detailed analysis also showed a synergistic action on liver tumor frequency on days 15 and 16. (orig./ECB).

6494 **(PNL—6067-Vol.1) Recommended procedures for performance testing of radiobioassay laboratories: Volume 1, Quality assurance.** Fenrick, H.W.; MacLellan, J.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 33p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004254/JAW.

Draft American National Standards Institute (ANSI) Standard N13.30 (Performance Criteria for Radiobioassay) was developed in response to a concern expressed by the US Department of Energy and US Nuclear Regulatory Commission to help ensure that bioassay laboratories provide accurate and consistent results. The draft standard specifies the criteria for defining the procedures necessary to establish a bioassay performance-testing laboratory and program. The testing laboratory will conduct tests to evaluate the performance of service laboratories. Pacific Northwest Laboratory helped define responsibilities and develop procedures as part of an effort to evaluate the draft ANSI N13.30 performance criteria for quality assurance at bioassay laboratories. This report recommends elements of quality assurance and quality control responsibilities for the bioassay performance-testing laboratory program, including the qualification and performance of personnel and the calibration, certification, and performance of equipment. The data base and recommended records system for documenting radiobioassay performance at the service laboratories are also presented. 15 refs.

6495 **(PNL—6067-Vol.2) Recommended procedures for performance testing of radiobioassay laboratories: Volume 2, In vitro samples.** Fenrick, H.W.; MacLellan, J.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 35p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004255/JAW.

Draft American National Standards Institute (ANSI) Standard N13.30 (Performance Criteria for Radiobioassay) was developed for the US Department of Energy and the US Nuclear Regulatory Commission to help ensure that bioassay laboratories provide accurate and consistent results. The draft standard specifies the criteria for defining the procedures necessary to establish a bioassay performance-testing laboratory and program. The bioassay testing laboratory will conduct tests to evaluate the performance of service laboratories. Pacific Northwest Laboratory helped develop testing procedures as part of an effort to evaluate the performance criteria by testing the existing measurement capabilities of various bioassay laboratories. This report recommends guidelines for the preparation, handling, storage, distribution, shipping, and documentation of in vitro test samples (artificial urine and fecal matter) for indirect bioassay. The data base and recommended records system for documenting radiobioassay performance at the service laboratories are also presented. 8 refs., 3 tabs.

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 6413, 6418, 6420

6496 **(CONF-881070—2) Zygote-derived developmental anomalies, a new endpoint of mutagenesis in mice.** Generoso, W.M.; Rutledge, J.C. (Oak Ridge National Lab., TN (USA); Children's Hospital and Medical Center, Seattle, WA (USA). Dept. of Labs.). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003929/JAW.

From Symposium on multi-level health effects research: molecules to man; Richland, WA, USA (17 Oct 1988).

There are many chemicals to which certain groups of humans are exposed and for which induction of transmissible mutations in mice has been demonstrated. Assessment of genetic risk to humans from these environmental mutagens requires accurate identification and quantification in experimental systems of the types of mutagenic damage that they can produce in the germ line and which can be transmitted to the conceptuses. Conventionally the types of genetic damage considered in this process are gene mutations (dominant, semidominant, and recessive), small deficiencies, structural chromosomal anomalies (reciprocal translocations, inver-

sions, duplications, etc.), and numerical chromosomal anomalies (whole chromosomes missing or in excess). This report presents yet another type of mutagenic response, albeit its nature is still unknown. 13 refs.

6497 (CONF-8511341—) **IMA seminar on forest damage research 'Stresses and injuries on the ecosystem level and their consecutive results'.** (Umweltbundesamt, Berlin (Germany, F.R.)). May 1986. 268p. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

This seminar report summarizes ecosystem projects in forest damage research. Subject group 1 (model theory approaches) focusses on models which use statistical methods to detect and cover natural processes, and which simulate natural processes in a predefined mathematical model. Subject group 2 concerns stress analyses and substance balances of forest ecosystems; the papers also deal with emission inputs as stress factors in terrestrial ecosystems, with means and methods to reduce their adverse effects, and with the distribution of trace substances (heavy metals) in forest ecosystems. Subject group 3 comprises papers on aspects of pollutant action and on consecutive results of ecosystem stresses (e.g. combination effects of heavy metals and acidic soils on beech regeneration and restocking, changes in species spectra under the influence of emission inputs and their results). 20 papers of this seminar report were abstracted for separate entry into the data base.

6498 (CONF-8511341—, pp 13-36) **Synoptical representation of possible forest-dieback causes.** Schroeder, W.; Vetter, L. (Kiel Univ. (Germany, F.R.). Geographisches Inst.). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Based on a scientific theoretical skeleton concept which was used both for the evaluation of forest damage hypotheses and for reviewing the results of computer-assisted evaluation of geoscientific maps, a data processing model was elaborated which meets both incidence statistics and regional statistics aspects. In addition, the results of the multivariate approach were discussed. Cross tabulations which provide for a statistical explanation pattern of the predictor variables 'forest damage classes', furnish findings which are helpful for further research process. Data were subjected to a regional statistics analysis in order to characterize the potential stresses of individual sites. Evaluation of small-scale maps was exemplified by the 'Schwarzenbach an der Saechsischen Saale' sheet of the Bavarian map scaled 1:25,000.

6499 (CONF-8511341—, pp 37-40) **Analysis and model of the chemical stress of forest systems.** Ries, L. (Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer Hydrologie). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Multivariate statistical methods are used to analyse the damage causes of forest dieback while comparing them with the data on chemical site characteristics. Treetop injury and fine-root length were selected as damage parameters. Chemical site characteristics were, e.g., root-contained substances, mineral contents of drilled cores and needles, cation availability in soil solution, Ca-to-Al ratio. The results of chemical measurements provide for some cautions diagnostic suggestions for the development of treetop-injury classes and for the relative changes in mean site-related fine-root length.

6500 (CONF-8511341—, pp 41-54) **Forest dieback in Central Europe under chronic exposure to air-borne pollutants: A dynamic model using nonlinear dose-effect relations.** Kohlmaier, G.H.; Ploechl, M. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Physikalische und Theoretische Chemie; Frankfurt Univ. (Germany, F.R.). Zentrum fuer Umweltforschung). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

The model of reduced photosynthesis and refoliation under chronic exposure to pollutants is extended to include processes occurring in the soil with special reference to increased fine-root turnover. Availability and uptake of major nutrients will be included, too, at a later stage. The demand for and the distribution of assimilates are ranked hierarchically: respiration, formation of leaves and roots, wood growth. The effect of individual pollutants on leaves and roots depends both from their instantaneous impact at high concentrations and from their accumulation during total exposure while considering their elimination and repair mechanisms. The simulation calculations show that our forests will be given a chance for recovery only if air pollution levels are reduced at once.

6501 (CONF-8511341—, pp 55-70) **Time maps as a method for testing forest damage hypotheses - a system-dynamics model approach.** Schaller, J. (Environmental Systems Research Inst. (ESRI), Kranzberg (Germany, F.R.)). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

A new methodology ('chronomaps' or 'time maps') allows to demonstrate the spatial and temporal development of forest damage in dependence from a given hypothesis as a 'time series' of computer-drawn maps. The hypothesis-dependent maps reflecting the current forest condition of a given area can be compared with the real course of damage either by in-situ inspection or by aerial photographs; as a result, previous years can also be rated by comparing older records and aerial photographs. This methodology provides for an immediate, differentiated and small-area comparison of any hypothetical statement with reality.

6502 (CONF-8511341—, pp 71-96) **Assessment of the effects of the new forest damage types on yield in the Hamburg Forestry Administration territory using dynamic models of forest growth.** Schneider, T.W. (Bundesforschungsanstalt fuer Forst- und Holzwirtschaft, Hamburg (Germany, F.R.). Inst. fuer Weltforstwirtschaft). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

The studies concerned changes in the growth of trees and stands damaged by emission inputs. Numerous results are available in literature on the growth behaviour of damaged firs or spruces. All authors report declines in the trees' growth in height and diameter. Conventional planning tools like yield tables fail to sufficiently describe these declines on a stand level. Hence, dynamic growth simulation models were developed to be used for the ecological and economic evaluation and planning of complex forest ecosystems.

6503 (CONF-8511341—, pp 97-109) **Man-made emission inputs as stress factors in terrestrial ecosystems and means and methods to abate their damaging effects.** Fabig, W.; Oldiges, H. (Fraunhofer-Institut fuer Umweltchemie und Oekotoxikologie, Schmallenberg (Germany, F.R.)). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

A site-related survey was performed on two spruce sites of different elevations in the Hochsauerland with the aim to detect and describe potential biotic and nonbiotic damaging impacts. These factors were compared and correlated to identify site-specific impacts which may result in an observed damage type and severity. Pollutant inputs were established for 1984 and contrasted with the emission-input and weather situations. The studies also concerned possible changes in soil and epigeal fauna and microbial composition.

6504 (CONF-8511341—, pp 110-119) **Pollution load of conifer forest ecosystems - comparison of two study objects.** Evers, F.H. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Stuttgart (Germany, F.R.). Abt. Botanik und Standortskunde). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

The author shows the comparison of the data of various ecosystem analyses to be helpful in identifying research gaps which may be bridged by a hypothesis for the time being. The case presented by the author explains severe damage to spruce stands as a result of acid toxicity in the root area, nutritional disturbances and a distinct period of drought.

6505 (CONF-8511341—, pp 120-130) **Element output and input/output balances in various woodland regions of Northern Germany.** Matzner, E.; Bredemeier, M. (Goettingen Univ. (Germany, F.R.). Inst. fuer Bodenkunde und Waldernaehrung). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Based on measurements performed for element input, output and uptake in stands, changes in reserves (input/output balances) are demonstrated for the compartment of soil of various forest ecosystems. The data prove all soils studied to have negative balances for the nutrients K, Ca, and Mg. Al-release rates differ in dependence from chemical soil condition and pollution situation. In case of Al, the dynamics of Al sulphates in the soil need to be considered, too, which is demonstrated by means of an example.

6506 (CONF-8511341—, pp 131-141) **Rates of ecosystem-internal acid production in various forest ecosystems.** Bredemeier, M. (Goettingen Univ. (Germany, F.R.). Inst. fuer Bodenkunde und Waldernaehrung). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

The author presents the rates of deposition and ecosystem-internal net production of H/sub 3/O/sup +/ ions in two forest ecosystems of the North German Lowland, and compares these with the corresponding rates in forest ecosystems in the Solling. The approach to the quantification of these rates from ecosystem flow balances is explained and discussed. Processes of ecosystem-internal acid production involve accumulation of cation excess in biomass growth, accumulation of cation excess in raw humus, production and dissociation of organic acids and output of acid anions by seepage water, uptake of an excess of deposited NH/sub 4/-N as against deposited NO/sub 3/-N, and buffering of deposited hydrogen ions in the treetop zone. The accumulation of an excess of basic cations in biomass growth which should be understood as the only definitive ecosystem-internal acid source, makes up for less than 25% of total acid load in three of the four forest ecosystems studied.

6507 (CONF-8511341—, pp 142-152) **Distribution of trace substances (heavy metals) in forest ecosystems.** Lamersdorf, N. (Goettingen Univ. (Germany, F.R.). Inst. fuer Bodenkunde und Waldernaehrung). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Studies on the distribution of trace elements in forest ecosystems have two purposes: they provide the basis for substance balancing and, from an ecophysiological point of view, they provide important insight into those concentration areas as will be found in individual micro-compartments. The author's intention is to characterize the quantitative occurrence of trace substances in forest ecosystems more accurately, to discrimate elements for their qualitatively different behaviours, and to give a more comprehensive survey on the input, residence and output of trace substances in forest ecosystems. The studies also involved the elements As, Se, Bi, and Tl in addition to the previously studied elements Cr, Co, Cd, Cu, Ni, Pb, and Zn.

6508 (CONF-8511341—, pp 153-168) **Sulfur and heavy metals: Their turnover among ecosystem components, their distribution across ecosystem compartment, and their (in-)direct effects on organisms.** Schlichting, E. (Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Bodenkunde und Standortslehre). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

The author presents the examination methodology for and initial results of balancing studies in ecochores exemplified by the Denzenberg sandstone valley. No or negligible seasonal pH variations were observed in precipitations. Diminished inputs of SO/sub 4/ and NO/sub 3/ as a result of reduced precipitation quantities and hardly altered outputs of SO/sub 4/ and NO/sub 3/ may be expected to produce a negative SO/sub 4/ balance and a levelled NO/sub 3/ balance in contrast to positive balances obtaining to date. Heavy metals investigated to date revealed Fe, Cu, and Pb to be retained in the treetops at varying amounts. This is where especially Mn, Zn, and Cd, too, are washed out, and all heavy metals except Fe are accumulated in the soils. To separate run-off components, near-surface slope run-off (interflow) was measured at an appropriate site and determined to make up 60% of total run-off during a precipitation run-off event. To study effects in ecotopes, mineralization of organic matter was linked to established climatic and edaphic site factors. Current N mineralization in the mainroot zone exceeds NO/sub 3/ input by precipitations by far.

6509 (CONF-8511341—, pp 171-178) **Seasonal variations of pedochemical characteristics in forest soils as a result of recurrent acidification events.** Matzner, E. (Goettingen Univ. (Germany, F.R.). Inst. fuer Bodenkunde und Waldernaehrung). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

High rates of acid deposition in forest ecosystems result in enhanced soil acidification. This anthropogenically induced process is superimposed by natural processes in the soil involving acid production and consumption. Peak loads of acid must be expected if enhanced nitrification and nitrate accumulation in the soil occur as a result of warm/dry years. Recurrent acidification events were studied in 4 forest soils with different acidification levels. The ecotoxicological effect of recurrent acidification on fine roots depends largely from the base saturation available at the exchanger in the soil. Acidic depositions reduce base saturation and, thus, enhance

the risk of root injuries due to acidification events induced by weather conditions.

6510 (CONF-8511341—, pp 179-189) **Combination effects of heavy metals and acidic soils on beech regeneration.** Kahle, H. (Bielefeld Univ. (Germany, F.R.). Abt. Oekologie). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Experimental approaches were selected within the project aiming at an improved assessment of the toxicity of some heavy metals on trees and shrubs; dose-effect tests for lead and cadmium were performed on young beech trees (Fagus sylvatica). The project focussed on three substudies: 1) Uptake and distribution of Cd in young beech trees and its effect on transpiration; 2) The influence of increasing soil-borne lead concentration levels on the root growth of beech seedlings; 3) Seedling and young-tree development of Fagus sylvatica under Pb and Cd stress on an acidic and a basic forest soil. Heavy metals like Cd and Pb and their present-time concentrations in forest soils or tree roots cannot be assumed to be the main causative factors of the 'new types of forest damage'; however, heavy metals are an accompanying stress factor which may be expected to effect a long-term vitality depression in forest trees especially if soil acidification and input of heavy metal emissions continue.

6511 (CONF-8511341—, pp 190-192) **Significance of mercury for the fauna of forest ecosystems.** Bombosch, S. May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Transport and biological accumulation of mercury in forest ecosystems was investigated. The mercury content in spruce needles, litter and humus was analysed as well as its biological accumulation in insects, annelids, fishes and wild boars. The results are briefly discussed.

6512 (CONF-8511341—, pp 193-207) **Resistance and competition of forest canopies influenced by acid deposition.** Steubing, L. (Giessen Univ. (Germany, F.R.). Inst. fuer Pflanzenoekologie). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

The influence of sulfur dioxide on forest plants like Allium ursinum, Milium effusu and others was proved in several experiments. The two species showed a different degree of resistance. Especially high concentrations of SO/sub 2/ occurring for a short time had a significant effect on leaf surface, photosynthesis, transpiration, chlorophyll content and enzymatic activity.

6513 (CONF-8511341—, pp 208-217) **Changes in the herb layer of beech tree forests.** Wittig, R. (Duesseldorf Univ. (Germany, F.R.). Abt. Geobotanik). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

In Northern Europa soil pH in the stem flow area of beech tress (Fagus sylvatica L.) decreased since a couple of years. This investigation was carried out in order to find out whether the decrease of soil pH and the increase of acid-indicators in the stemflow area are correlated. The results gained are briefly discussed with the final conclusion, that the observed phenomena are caused in all probability by anthropogenic air pollutants.

6514 (CONF-8511341—, pp 218-228) **Succession of the species spectrum influenced by fertilizing pollutants and their consequences.** Ellenberg, H. (Bundesforschungsanstalt fuer Forst- und Holzwirtschaft, Hamburg (Germany, F.R.). Inst. fuer Weltforstwirtschaft). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

By means of herb-layer plants as biological indicators, the author tries to prove the fertilizing effect of nitrogen introduced by air pollution. The consequence of nitrogen deposition is that it triggers a succession in the plant community.

6515 (CONF-8511341—, pp 229-235) **Dendrochronological annual-ring-analysis studies on mixed forests in Bavaria.** Elling, W. (Fachhochschule Weihenstephan, Freising (Germany, F.R.). Fachbereich Forstwirtschaft). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Studies are aimed at determining the 'patient history' of forest trees and at determining the share of extreme weather conditions in the causal complex of forest diseases. To this end, the data of annual-ring-width measurements are processed dendrochronologically. In addition, weather-dependent growth conditions and annual ring widths are compared using statistical methods. Dendrochronological verification of annual ring deficiencies indicates great differences in annual-ring structure and build-up for the tree species studied. Silver firs also reveal great regional variations.

6516 (CONF-8511341—, pp 236-248) **Growth responses in individual trees and tree groups in North German stands of spruce, pine and douglas fir.** Lorenz, M. (Bundesforschungsanstalt fuer Forst- und Holzwirtschaft, Hamburg (Germany, F.R.). Inst. fuer Weltforstwirtschaft). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Annual ring and trunk analyses were performed to study dominant individual trees exhibiting different damage stages sampled in four North German sites of spruce, pine and douglas fir stands. One site revealed douglas fir and spruce to have been subjected to a nonclimatic growth-reducing factor for a decade prior to the 1976 drought year with its unusual growth response. After 1976, annual volume growth averaged but 50 to 60% of the volume increase of the previous years even in those spruce and douglas fir trees which were rated as externally unharmed by surveying. No clear differences were found in the growth responses of all three tree species in an interspecies comparison for all sites.

6517 (CONF-8511341—, pp 249-259) **Studies on the influence of natural surface waters on the embryonic and larval development of the clawed toad (Xenopus laevis).** Dumpert, K. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). May 1986. (In German). NTIS (US Sales Only), PC A12/MF A01. Order Number DE89770108/JAW.

From IMA seminar on forest damage research stresses and injuries on the ecosystem level and their consecutive results; Berlin, F.R. Germany (25 Nov 1985).

Umweltbundesamt - Texte.; no. 17/86.

Pilot studies were performed to clarify whether or not the sprawn of the clawed toad (Xenopus laevis) responds to the water of polluted natural surface waters in such a sensitive way as to allow the development stages of this species to be used as a test organism for investigations into the potential influence of environmental contaminants on the decline among native amphibians. Indeed, the waters tested showed marked effects suggesting suffi-

cient sensitivity of Xenopus embryos and larvae for application as a biological indicator in future tests.

6518 **(CONF-8610447—) Status colloquium 'Air pollution and forest decline'. Lectures and discussions.** (Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). May 1987. 195p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770140/JAW.

From Status colloquium on air pollution and forest decline; Duesseldorf, F.R. Germany (29 Oct 1986).

The scientific part of this event was divided into the following subject categories: Investigation of effects - a) effects of air pollution on the epigeous parts of trees, b) effects of air pollution on trees via the soil - atmospheric processes, measurements of nuisances and depositions in areas of forest disease, measures to remedy damage, emission control techniques. This conference volume contains the complete lectures and, as an appendix, the pertaining discussion contribution.

6519 **(DOE/ER/60257—4) [Integration of experimental and modeling approaches to study competitive interactions among plants under elevated CO_2]: Annual report, 1987--1988 and Request for funds, 1988--1989.** Bazzaz, F.A. (Harvard Univ., Cambridge, MA (USA). Dept. of Organismic and Evolutionary Biology). 22 Sep 1988. Contract FG02-84ER60257. 10p. NTIS, PC A02/MF A01. Order Number DE89003359/JAW.

The system was restarted in February 1988 with a two-stage experiment. The experiment chosen is not required as a primary objective of the grant, but was chosen as an important question that would provide an opportunity to debug the system and to assure quality control before commitment to a priority investigation. Initial difficulties were encountered with very high ambient CO_2 levels in the Glasshouse, which was rectified before the start of the experiment. The physical plant and personnel performed well during the first phase of "500 Effect" experiment (low nutrient test). Following harvest of this first phase, the CO_2 chambers were overhauled and then upgraded by replacement of their casings. In addition, supervision of the project was transferred to two new postdocs (Suzanne Morse and Jim Coleman) appointed to the lab for this purpose. The second phase of the "500 Effect" experiment (high nutrient conditions) is now underway, with a projected completion date of late October. 6 refs.

6520 **(FO/BI—1575) Proceedings of the 13th Annual Aquatic Toxicity Workshop.** Lakshminarayana, J.S.S. (ed.). (Department of Fisheries and Oceans, Burlington, Ontario (Canada). Bayfield Inst.). 1987. 206p. (In English and French). (CONF-8611276—; MICROLOG—88-01709). Dept. of Fisheries and Oceans, Scientific Information and Publications Branch, 200 Kent Street, 12th. Floor, Ottawa, Ont., Canada K1A 0E6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

From 13. annual equatic toxicity workshop; Moncton, Canada (12 Nov 1986).

This workshop was one of a continuing series of annual workshops in Canada on aquatic and environmental toxicology, covering topics including the principles of aquatic toxicology, applications in environmental effects monitoring setting of toxicity criteria in regulations and guidelines, and the development of water quality objectives. The workshops emphasize an informal exchange of ideas and knowledge on the topic among interested persons from industry, governments, consulting firms and universities. The workshops provide an annual focus in Canada on the principles and approaches in aquatic toxicology, and the role of aquatic toxicology in the prevention and control of water pollution. In this year's workshop, 50 papers were presented in the following areas: acid rain, metals and radionuclides in aquatic organisms, biological availability and effects of particle bond contaminants, pesticides in forestry and agriculture, fish epidemiology and pollution effects on aquatic biota, aquatic toxicity to fish, sediment toxicity testing, aquatic toxicology and the management of marine environmental quality, and environmental assessment. This volume only contains abstracts or extended abstracts of the papers, special addresses and summaries of the special workshop sessions, together with an author index and a list of participants. 13 refs., 23 figs., 9 tabs.

6521 **(IS—4957) Ames Laboratory quarterly report, January 1, 1988--March 31, 1988.** (Ames Lab., IA (USA)). May 1988. Contract W-7405-ENG-82. 53p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003827/JAW.

This report describes the research programs of Ames Laboratory in the areas of high-resolution, high-sensitivity spectroscopies; toxic compounds and metabolites present in environmental and biological samples; and quantitation in electrophoresis based on lasers. 34 refs., 13 figs., 4 tabs. (TEM)

6522 **(NP—9770104) Biological indicators of environmental quality in the Elbe, Weser, and Ems estuary. Pt. 3. Monitoring of cadmium, lead, nickel, copper, and zinc in barnacles (Cirripedia: Crustacea), gammarids (Amphipoda: Crustacea) and enteromorpha (Ulvales: Chlorophyta).** Zauke, G.P.; Meurs, H.G.; Todeskino, D.; Kunze, S.; Baeumer, H.P.; Butte, W. (Oldenburg Univ. (Germany, F.R.). Fachbereich 7 - Biologie; Umweltbundesamt, Berlin (Germany, F.R.)). Jul 1987. 161p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE89770104/JAW.

Scope of this study was to evaluate the suitability of estuarine organisms for biological monitoring of heavy metals. At first, we investigated the variability of metal concentrations in the organisms. Regarding barnacles of the genus Balanus, the influence of the intensity of colonisation and the basal area of shells were considered; regarding amphipods of the genus Gammarus, the influence of dry mass of individuals, species composition, and heterogeneity of microhabitats respectively. Regarding green algae of the genus Enteromorpha, the influence of sample preparation (for example cleaning solutions) was considered. Secondly, we investigated the spatial and temporal variability of metals in the species mentioned above comparing collections from the Elbe, Weser and Ems estuary. The results are summarised also giving bioconcentration factors (referring to field conditions) and element ratios as compared to the river waters. Finally, we propose a scheme for biological monitoring of heavy metals in the estuaries. (orig.) With 75 refs., 53 tabs., 19 figs.

6523 **(NP—9770105) Biological indicators of environmental quality in the Elbe, Weser, and Ems estuary. Pt. 2. Bioaccumulation and toxicity of cadmium in gammarids under static laboratory and dynamic in-situ conditions.** Zauke, G.P.; Lemm, R. von; Meurs, H.G.; Todeskino, D.; Baeumer, H.P.; Butte, W. (Oldenburg Univ. (Germany, F.R.). Fachbereich 7 - Biologie; Umweltbundesamt, Berlin (Germany, F.R.)). Jul 1986. 156p. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770105/JAW.

The bioaccumulation of cadmium in Gammarus species from the Elbe, Weser, and Ems estuary was investigated to evaluate the suitability of these animals as indicators of the bioavailability of heavy metals. Experiments were performed under static laboratory and dynamic in-situ conditions. Exposition to water containing 3-20 {mu}g Cd/l caused increasing Cd body-burden in gammarids in the range of 5-18 mg/kg d.w. within 7-10 d (control: 0.5-1.5 mg/kg). Differences between gammarid collections from the Elbe, Weser, and Ems estuary and from different locations of the Weser estuary were detected on the basis of the observed bioconcentration factors as well as on the basis of calculated BCF's using a deterministic two-compartment model. Preliminary results of ecotoxicological investigations did not reveal Cd-specific effects but differences in mortality and population parameters due to the general experimental conditions, to species, and to sampling sites. (orig.) With 93 refs., 48 tabs., 21 figs.

6524 **(NP—9770114) Comparative study of the heavy metal bill of different forest ecosystems in northern Germany.** Schultz, R. (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1987. 225p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770114/JAW.

The study compares 8 different forest ecosystems as to their heavy-metal balance. The heavy metals investigated are chromium,

cobalt, nickel, copper, zinc, cadmium, and lead. The stands differ in respect of their geological substrates (sediment rock with a cover of loess, periglacial sand), tree species (beech, oak, spruce, pine), their exposure and their disease manifestations. Over a period of two years (1983-1985), precipitation in areas without trees, crown throughfall, stem-flow water, litter, and the seepage water under the humus layer as well as under the mineral soil holding the roots were continuously collected. By means of the heavy metal contents the flow rates were measured. A bill made up for all the flow rates covered describes the behaviour of the different heavy metals within the overall system.

6525 **(NP—9770121) Distribution and accumulation of trace amounts in forest ecosystems.** Lamersdorf, N. (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1988. 240p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE89770121/JAW.

The work focuses on the comparison of the contents in trace amounts of individual compartments (needles, the bark of branches and stem, stem wood, different root fractions, organic ground cover, mineral soil) of three spruce forest ecosystems. Moreover a comparison of sites was made by examining spot samples from a spruce forest ecosystem (needles, bark), a beech forest ecosystem (bark, wood), and two forest stands of different leaf trees (beech, English oak; organic ground covers). The following elements were examined in varying intensities in the groups of samples: As, Bi, Pb, Cd, Se, Tl, Cr, Co, Cu, Mn, Ni, Zn, Sb, Be, Hg, Fe, Mo and V. The analytical effort involved depended for one thing on the wish to complete available knowledge on the distribution of trace amounts in forest ecosystems, and for the other on the desire to verify by means of a damaged spruce stand, whether the accumulation or depletion of trace amounts are in part responsible for forest disease in the north-west German coastal region. In parallel to these investigations, available data regarding the bills for main substances and trace amounts from other research projects were made use of. As a basis for characterizing and judging the trace substance concentrations ascertained in the forest ecosystems, the book gives an overview of the state of knowledge in the form of a bibliography.

6526 **(NP—9770135) Development of a bioaccumulations test using the mussel Mytilus edulis. Sections 1-3.** Ernst, W.; Weigelt, S.; Weigelt, V.; Rosenthal, H.; Hansen, P.D.; Chutsch, M. (Alfred-Wegener-Institut fuer Polar- und Meeresforschung, Bremerhaven (Germany, F.R.); Biologische Anstalt Helgoland, Hamburg (Germany, F.R.); Bundesgesundheitsamt, Berlin (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). Apr 1987. 205p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770135/JAW.

Mussels, Mytilus edulis, of varying origin and maintenance were used to determine bioconcentration factors for a variety of compounds. Bioaccumulation is little influenced by origins and maintenance but significantly by the condition factor and also the lipid content. Bioconcentration factors obtained from flow-through-tests, simultaneously run with a variety of compounds, were in good agreement with the results of the static test. The elaboration of testing phagocytosis in mussels resulted in the quantification of stress in the test animals due to transport and maintenance. (orig.) With 43 refs., 32 tabs., 64 figs.

6527 **(NP—9770139) Aluminium tolerance of species grown on basic to moderately acidic, and acidic soils as a function of the form of nitrogen and supply of phosphate.** Rode, M.W. (Goettingen Univ. (Germany, F.R.). Systematisch-Geobotanisches Inst. und Neuer Botanischer Garten). (Goettingen Univ. (Germany, F.R.). Forschungszentrum Waldoekosysteme - Waldsterben). 1988. 210p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770139/JAW.

The aluminium tolerance of species growing on basic to moderately acidic soils (C. remota, B. sylvaticum, O. vulgare, G. urbanum, M. muralis) and on acidic soils (J. squarrosus, A. flexuosa, C. vulgaris, G. harcynicum, D. purpurea) was tested as a function of the form of nitrogen and supply of phosphate in nutrient solution cultures. The following questions were investigated: Are the examined species different as to nitrogen uptake and especially as to OH/sup -/ or H/sup +/ release? Are nitrogen uptake and/or the release of OH/sup -/ respectively H/sup +/ influenced by aluminium? Does increased precipitation of aluminium have an influence on its toxicity?

6528 **(SRC—E-902-1-A-88) Response of wheat, canola and alfalfa to simulated acidic precipitation.** Abouguendia, Z.M.; Lawrence, A.; Godwin, B.; Godwin, R. (Saskatchewan Research Council, Saskatoon (Canada)). [1988]. 20p. (CE—02056). Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $N/C.

Wheat, canola and alfalfa were subjected to simulated acidic precipitation with pH ranging from 5.6 to 2.6 under controlled growth room conditions. In this short-term experiment, wheat, canola and alfalfa do not appear to be sensitive to the simulated acid rain treatments used. Wheat and canola showed no visible symptoms of injury with any of the treatments. The pH 2.6 resulted in whitish spots on alfalfa leaflets. The economic yield was not affected at any of the acidity levels used in this study. Dry weight of the aboveground vegetative parts of wheat and canola was stimulated by the most acidic treatment (pH 2.6), apparently as a result of the higher nutrient content of the simulated acid rain. Although belowground biomass for any of the species tested was not affected by rain acidity, the shoot:root ratio was significantly higher at pH 2.6 than with the control. Chlorophyll a concentration in alfalfa leaves was reduced at only the highest acidity treatment. Chlorophyll b was not affected. While potassium levels in alfalfa leaves were significantly reduced at pH 2.6, no change in the concentration of Ca, Mg and P was noted. Sulfur and nitrogen concentrations increased, mainly at pH 2.6, reflecting the composition of the simulated rain solution. 17 refs., 1 fig., 10 tabs.

6529 **(UCRL—21054) Health risk assessment of 1,1,1-trichloroethane (MC) in California drinking water.** Hall, L.C.; Bogen, K.T.; McKone, T.E.; Mallon, B.; Hall, C.H. (Lawrence Livermore National Lab., CA (USA)). 16 Nov 1988. Contract W-7405-ENG-48. 180p. NTIS, PC A09/MF A01 - OSTI. Order Number DE89003457/JAW.

This document presents an assessment of the potential health risks associated with exposure to 1,1,1-trichloroethane (methyl chloroform, or MC) dissolved in California drinking waters. This assessment is being provided to the California Department of Health Services (CDHS) for the development of drinking-water standards to manage the health risks of MC exposure. Other assessments required in the risk-management process include analyses of the technical and economic feasibilities of treating water supplies contaminated with MC. A primary goal of this health-risk assessment is to evaluate dose-response relationships for observed and potential toxic end points of MC in order to define dose rates that can be used to establish standards that will protect members of the general public from adverse health effects resulting solely from water-based exposures to MC. We also analyze the extent of human exposures attributable to MC-contaminated groundwater in California. The document consists of seven sections, plus supporting appendices. Our assessment begins in Section 2 with a review of the uses of MC, its environmental chemistry, and concentrations measured in different environmental media. The next section provides an overview of published studies on the absorption, distribution, metabolism, and elimination of MC. Also included in Section 3 is a review and analysis of physiologically based pharmacokinetic models for predicting MC metabolism in animals and humans. In Section 4, we review studies of the acute, subchronic, and chronic toxicity of MC to animals, including a summary of data from bioassays conducted to evaluate its potential carcinogenicity. We also provide an overview of MC's health effects in humans and examine human data on MC's toxic effects on specific organs and systems. 305 refs., 7 figs., 18 tabs.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 7022

6530 **(CONF-8811101—1) Optimizing compliance training for DOE workers.** Copenhaver, E.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003241/JAW.

From 12. annual TRADE conference; San Francisco, CA, USA (7 Nov 1988).

Department of Energy workers are required to participate in special training mandated by a variety of Federal laws and DOE Orders. Workforces in production, environmental and health protection, emergency response, transportation, waste management, and research are all subject to mandatory requirements in DOE Orders and other regulations such as the Resource Conservation and Recovery Act (RCRA), Superfund Amendments Reauthorization Act (SARA) as implemented by OSHA in CFR 1910.120, in addition to requirements for Hazard Communication, Radiation Workers, Respiratory Protection, Transportation, and Waste Generator training. The Technical Resources and Training Program is examining the course contents of all the ESH compliance training offered at ORNL and the mandated requirements to determine how to best meld these requirements into a training program that will still fulfill all requirements but eliminate the potential for duplication of some elements in successive courses. This approach may not eliminate all duplication between courses, but it should result in significant savings in manhours demanded in a training environment which requires similar information to meet a host of regulatory requirements. The training matrix planned for Oak Ridge National Laboratory (ORNL) will be presented and discussed. 22 refs., 3 tabs.

6531 **(UBA-FB—86-110(1-3)) Investigation of the actual level of the safety technology and the deficiencies in the codes of practice in plants being subject to the Stoerfall-V (Hazardous Incidents Ordinance). Vol. 1-3.** Haferkamp, K.; Hein, M.; Rudolph, E.; Wietfeld, P. (Technischer Ueberwachungs-Verein Rheinland e.V. (TUeV), Koeln (Germany, F.R.). Zentralabteilung Chemieanlagen, Verfahrens- und Maschinentechnik; Technischer Ueberwachungs-Verein Norddeutschland e.V., Hamburg (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). 1 Oct 1987. 312p. (In German). NTIS, PC Exx; Available from NTIS as TIB.

Applying the experience got during safety auditing plants subject to the Stoerfall-V the actual level of the safety technology is outlined. In view of plants according to Appendix I, groups 4 and 5, the causes relevant to hazardous incidents are derived. According to these causes of hazardous incidents a system of safety principles is defines, enclosing the whole range of safety technology and, relying to plants according to Group 4, being valid for all plants of Appendix I of the Stoerfall-V. The application of this system of safety principles on safety analyses according to the Stoerfall-V leads to a catalogue of examples of safety-measures applied to plants, called the technical commentary. The system of safety principles is applied too to the actual technical codes of practice. It allows to discuss their principal set-up and their degree of liability. It will be proposed to extend the technical commentary as condition to a revision and completion of the technical provisions and codes of practice according to the Stoerfall-V. (orig.) With 2 refs., 229 tabs., 10 figs.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 6211, 6212, 6405, 7163

6532 **(DPST—88-841) August 1988 Savannah River Plant earthquake.** Stephenson, D.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Sep 1988. Contract AC09-76SR00001. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003835/JAW.

At 03:59:21.8 Universal Coordinated Time (UTC) on 5 August 1988 22:59:21.8 Eastern Daylight Time (EDT) and earthquake of local magnitude (M{sub L}) = 2.0 occurred on the Savannah River Plant (SRP), South Carolina. Using data from the South Carolina Seismic Network (SCNET) operated by the University of South Carolina (USC) Columbia for the United States Geological Survey (USGS) and the SRP Seismic Network (SRP SEISNET), the earthquake was located at 33{degree}12.94'N and 81{degree}39.81'W. The focal depth was calculated to be 2.86 km. The event was not felt onsite and the seismic alarms in plant facilities were not activated. This earthquake, which was only detected by seismometers within about 100 km of SRP, is the second to be recorded in historic time within the plant border. 12 refs., 6 figs.

6533 **(EMR—M42-378E) Lower carboniferous brachiopods from the Banff formation of western Alberta.** Carter, J.L. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1987. 113p. (MICROLOG—88-01702). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $12.00; OTHER COUNTRIES $14.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Investigations of well exposed Lower Carboniferous sedimentary rocks in the eastern Cordillera of Alberta and British Columbia provide important geological information for use in the exploration of correlative, petroleum-bearing strata in the adjacent subsurface to the east. This reports presents the systematic descriptions, biostratigraphic distribution and paleogeographic significance of brachiopod faunas from the Tournaisian Banff Formation. Brachiopods are the most common as well as the most diverse megafossils in this formation. Eighty-seven species assigned to fifty-three genera are identified from over 6,900 specimens in the collections of the Geological Survey of Canada. Two new genera, one new subgenus, and 24 new species are described. The stratigraphic distribution of the brachiopods makes possible the recognition of three brachiopod zones in the megafossil-bearing beds of the middle and upper Banff Formation. The lowest zone can be correlated with the Gilmore City Limestone (Iowa) but represents an interval of time between the Kinderhookian and Osagean not recorded in the upper Mississippi Valley standard section. The middle zone can be correlated with the lower Osagean strat of Missouri and the Mississippi Valley region. The upper zone correlates approximately with the Burlington Limestone at its type section in southeastern Iowa. The Banff brachiopod fauna has notable affinities with the fauna of the largely undescribed Lodgepole Formation of Montana and Wyoming. The only overseas faunal affinities are with the Tournaisian faunas of the Kuznets Basin in the southwestern Siberia and southeastern Kazakhstan. 113 refs., 75 figs., 2 tabs.

6534 **(EMR—M46-423E) Quaternary geology of the Tuktoyaktuk coastlands, Northwest Territories.** Rampton, V.N. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1988. 115p. (MICROLOG—88-02809). Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Ont., Canada K1A 0E4; $14.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report synthesizes observations made on the Quaternary geology of the Tuktoyaktuk Coastlands, providing a background for planning rational land use in an area of increasing oil and gas exploration activity. The Coastlands consist of a thick wedge of Pleistocene marine and fluvial sediments that contain much ground ice and have been modified by glaciation and thermokarst. Northwesterly moving continental (Laurentide) ice defined a glacial limit on Cape Bathurst peninsula around unglaciated terrain to the north, and major strandlines marking marine limits were formed, during the Middle Pleistocene. Northwesterly flowing continental ice again covered most of the area during the Early Wisconsinan and sediments were glacially deformed in peripheral areas. Westerly moving ice from Amundsen Gulf impinged on the eastern Cape Bathurst peninsula. Laurentide ice persisted in the southern Mackenzie Delta and Sitidgi Lake areas and deposited till, and sediments formed in the unglaciated Eskimo Lakes area. Extensive thermokarst activity during the Holocene produced thermokarst de-

posits and resulted in formation of the ice-cored topography. Valleys were drowned and filled with alluvium, and the Mackenzie Delta was formed. Rapid retreat of exposed coastlines has occurred. Periglacial processes and minor eolian activity and peat accumulation continued throughout the Holocene. Ground ice and subsidence resulting from its thaw represent major hazards to development, as does flooding of low-lying areas. Sand fill is a common resource, but coarser aggregate is only locally available. 176 refs., 83 figs., 24 tabs.

6535 **(UA—9003499) Computer modeling and simulation of Black Warrior Basin formation: Annual report for the 1987--1988 SOMED [School of Mines and Energy Development] project year.** Visscher, P.B. (Alabama Univ., University (USA). School of Mines and Energy Development). [1988]. 33p. OSTI - SOMED, P.O. Box 6282, University of Alabama, Tuscaloosa, AL 35487-6282. Order Number TI89003499/JAW.

Computer simulations have been performed, aimed at achieving a better understanding of the geological and physical processes involved in the formation of sedimentary basins in general and the Black Warrior basin of Alabama and Mississippi in particular. Microscopic-level computer modeling of sandstone porosity reduction has been done, elucidating the detailed small-scale dynamics which lead to the geological phenomenon of pressure solution. A new technique has been developed for 1D burial and thermal modeling of sedimentary basins based on stratigraphic data from test wells. It is significantly faster than previous methods, and can be used in interactive menu-oriented program requiring relatively little learning time or prior computer experience. This allows a geologist to rapidly determine the results of various different hypotheses about basin formation, providing insight which may help determine which is correct. A program has also been written to simulate tectonic-plate collisions and rifting processes using viscoelastic hydrodynamics.

5802 Geophysics

6536 **(CEA-DAS—475) Effects in Morocco of the Lisboa earthquake 1 November 1755.** Levret, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). May 1988. 26p. (In French). (CONF-8803170—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755622/JAW.

From Symposium on multidisciplinary evaluation of historical seismicity; Bologna, Italy (21 Mar 1988).

Within the framework of a cooperative agreement Sofratome/Office National d'Electricite of Morocco and Sofratome/Electricidade de Portugal, a study has been conducted as to the effects of the November 1, 1755 Lisbon earthquake in Morocco. This event, the effects of which have been described at length in Portugal, was likewise strongly felt in Morocco, especially on the Atlantic coast, which was laid waste not only through the direct agency of seismic waves, but also through that of a formidable tsunami. In old texts, the descriptions of these conjugate effects has been rendered with varying degrees of overstatement. The procedure adopted in order to arrive at a precise identification of the effects and their origin and an evaluation of intensity involves three stages: a) an assessment of the reliability of the documents used; b) a thoroughgoing analysis of the descriptions with the object of discriminating between the direct effects of the earthquake and those ascribable to the action of the tidal wave: c) a readjustment of the intensities by analysis of the global effects of the earthquake not only in Morocco but also in Portugal and Spain. Then a comparison of these with the well- documented effects of the recent, February 28, 1969 earthquake, originating at the same source. Extrapolated isoseismals for the effects in Morocco of the 1755 event derived from this study are then assigned. In the light of current knowledge concerning the historical seismicity of the Iberian African collision zone, an outline of the maximum observed intensities is proposed.

6537 **(FRCEA-TH—139) Study of earth deep structure from long period surface waves.** Montagner, J.P. (Paris-6 Univ., 75 (France)). Jul 1986. 298p. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE88755598/JAW.

Different methods of inversion of surface wave velocity are presented and applied to Pacific ocean, Africa and Indian ocean. Velocity lateral heterogeneities are found 400 km deep and correlation between surface tectonics and deep structure is better under Pacific ocean than under Indian ocean. Anomalies of S waves velocity and anisotropy directions can be separated. This method called vectorial tomography applied to Indian ocean shows the complexity of convection in the upper mantle.

6538 **(IFP—36-151) Acoustic wave propagation in porous media - interface effects (Theory and experiments).** Rasolofosaon, P. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). Nov 1987. 564p. (In French). NTIS (US Sales Only), PC A24/MF A01. Order Number DE88755595/JAW.

After a detailed presentation of the theory of propagation three experiments are described. In the first it is shown that the slow wave is not generated if there is no fluid flow between porous medium and surrounding water and energy is distributed on ordinary waves (P or S). In the second experiment rock plates are vibrated in the Lamb mode to show effects of permeability and viscoelacticity. In the third experiment wave propagation at the interface between a liquid and a satured rock is examined. Then permeability determination from acoustic data is discussed.

6539 **(UCID—21521) Seismic monitoring of the June, 1988 Salton Sea Scientific Drilling Program flow/injection test.** Jarpe, S.P.; Kasameyer, P.W.; Hutchings, L.J.; Hauk, T.F. (Lawrence Livermore National Lab., CA (USA)). 4 Oct 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89001857/JAW.

The purpose of the seismic monitoring project was to characterize in detail the micro-seismic activity related to the Salton Sea Scientific Drilling Program (SSSDP) flow-injection test in the Salton Sea Geothermal Field. Our goal was to determine if any sources of seismic energy related to the test were observable at the surface. We deployed our recording stations so that we could detect and locate both impulsive microearthquakes and continuous seismic noise energy. Our network, which was sensitive enough to be triggered by magnitude 0.0 or larger events, found no impulsive microearthquakes in the vicinity of the flow test in the 8 month period before the test and only one event during the flow test. This event has provided the opportunity to compare the detection and location capabilities of small networks and arrays in a geothermal environment. At present, we are carefully scanning all of the data that we collected during the flow test for evidence of anomalous seismic noise sources and for impulsive events smaller than the network detection threshold (magnitude 0.0). 8 refs., 4 figs.

6540 **(UCRL—96896) Designing arrays for modern high-resolution methods.** Dowla, F.U. (Lawrence Livermore National Lab., CA (USA)). Oct 1987. Contract W-7405-ENG-48. 6p. (CONF-871162—6). NTIS, PC A02/MF A01. Order Number DE88016282/JAW.

From 21. annual Asilomar conference on signals, systems, and computers; Pacific Grove, CA, USA (2 Nov 1987).

A bearing estimation study of seismic wavefields propagating from a strongly heterogeneous media shows that with the high-resolution MUSIC algorithm the bias of the direction estimate can be reduced by adopting a smaller aperture sub-array. Further, on this sub-array, the bias of the MUSIC algorithm is less than those of the MLM and Bartlett methods. On the full array, the performance for the three different methods are comparable. Improvement in bearing estimation in MUSIC with a reduced aperture might be attributed to increased signal coherency in the array. For methods with less resolution, the improved signal coherency in the smaller array is possible being offset by severe loss of resolution and the presence of weak secondary sources. Building upon the characteristics of real seismic wavefields, a design language has been developed to generate, modify, and test other arrays. Eigenstructures of wave-

fields and arrays have been studied empirically by simulation of a variety of realistic signals. 6 refs., 5 figs.

5803 Mineralogy, Petrology, And Rock Mechanics

6541 (DOE/ER/13259—T3) Chemical transport through continental crust: Final report. Papike, J.J. (South Dakota School of Mines and Technology, Rapid City (USA). Inst. for the Study of Mineral Deposits). 23 Nov 1988. Contract FG01-84ER13259. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003516/JAW.

This document summarizes the past years research on chemical transport in rock formations occurring in the north central United States. Principal topics include the Proterozoic granite-pegmatite system of the Black Hills, South Dakota: emplacement mechanisms and geochemical zonation; the Archean rocks of the Black Hills, South Dakota: Reworked basement from the Dakota segment of the Trans-Hudson Orogen; the mineralogical and chemical evolution of a rare-element granite-pegmatite system: evidence from the chemistry of potassium feldspar; the mass transfer during wall-rock alteration: an example from a quartz-graphite vein, Black Hills, South Dakota; and the inter- and intra-crystal REE systematics in apatite from the Bob Ingersoll pegmatite, Black Hills, South Dakota.

6542 (DOE/ER/13287—3) [Energetics of silicate melts from thermal diffusion studies]: Progress report for the second year's activities, January--December 1988. Lesher, C.; Walker, D. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). 1988. Contract FG02-84ER13287. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003045/JAW.

The second year of this three year renewal has been used to continue data collection and analysis of thermal (Soret) diffusion in silicate liquid and explore the related process of thermal migration in subliquidus magmas. During the past year we have expanded our experimental capabilities for thermal gradient work by the construction of two new miniaturized piston-cylinder devices capable of 20kb. This has greatly alleviated the bottleneck on our existing facilities and has permitted us to undertake long term thermal diffusion experiments which have been prohibitive in the past. Data collection efforts have also been materially aided by advances in thermal insulation in the pressure media outside our pressurized cylindrical heaters. $BaCO_3$ + 10%Cr_2O_3 is very effective in protecting the pressure vessel core from thermal deterioration with the result that the heater inside and outside diameters can be substantially increased. This permits several charges to be run simultaneously in an axisymmetric cluster around a double or triple junction thermocouple which can measure axial thermal gradients in situ. These thermal insulation and charge volume increase innovations also have been adapted in our on going studies of mineral-liquid element partitioning, silicate mineral dissolution and silicate liquid interdiffusion and should prove to be wide applicability and utility in other piston-cylinder laboratories, as well. 13 refs.

64 PHYSICS I

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 6586

6543 (CONF-8801129—1) Test of the second order asymptotic theory with low degree solar gravity modes. Barry, C.T.; Rosenwald, R.D.; Gu, Y.; Hill, H.A. (Arizona Univ., Tucson (USA). Dept. of Physics). 1988. Contract FG02-87ER13670. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003073/JAW.

From 171. meeting of the American Astronomical Society; Austin, TX, USA (10 Jan 1988).

Further testing of first and second order asymptotic theory predictions for solar gravity modes is possible with the work of gu and Hill in which the number of classified low-degree gravity mode multiplets was increased from 31 to 53. In an extension of the work where the properties of 31 multiplets were analyzed in the framework of first order asymptotic theory, a new analysis has been performed using the properties of the 53 classified multiplets. The result of this analysis again shows the inadequacy of first order asymptotic theory for describing the eigenfrequency spectrum and clearly demonstrates the necessity of using second order asymptotic theory. 30 refs.

6544 (CONF-8801129—2) The visual shape and multipole moments of the sun. Beardsley, B.J.; Hill, H.A. (Arizona Univ., Tucson (USA). Dept. of Physics). 1988. Contract FG02-87ER13670. 12p. NTIS, PC A03 - OSTI. Order Number DE89003072/JAW.

From 171. meeting of the American Astronomical Society; Austin, TX, USA (10 Jan 1988).

Solar diameter measurements made in 1983 at the Santa Catalina Laboratory for Experimental Relativity by Astrometry (SCLERA) have been analyzed for the Sun's quadrupole and hexadecapole shape terms. Expressing the Sun's apparent diameter as a Legendre series, these two terms represent the P_2 and P_4 coefficients, respectively. The theoretical framework used to provide a relationship between the observed shape of the Sun and the multipole moments of the solar gravitational potential fields has been improved to include in general the effect of differential rotation in both latitude and radius. The gravitational potential multipole moments, expressed as the P_2 and P_4 coefficients of a Legendre series, have been found to be J_2 = (3.4 +- 1.0) E-6 and J_4 = (1.7 +- 1.1) E-6, respectively. The total apparent oblateness ΔR = (equator-polar radii) found from SCLERA observations is ΔR = 13.8 milliarcseconds. The surface rotation contribution $\Delta R'$ to the apparent solar shape is $\Delta R'$ = 7.9 milliarcseconds. The quoted uncertainties represent formal statistical 1 σ errors only. Evidence for periodic shape distortions near the equator have also been found. 30 refs., 1 fig., 3 tabs.

6545 (CONF-8809146—3) Observed asymptotic properties of low-degree solar gravity-mode eigenfrequencies. Gu, Ye-ming; Hill, H.A.; Rosenwald, R.D. (Arizona Univ., Tucson (USA). Dept. of Physics). 1988. Contract FG02-87ER13670. 6p. NTIS, PC A02/MF A01. Order Number DE89003071/JAW.

From Seismology of the sun and sun-like stars; Puerto de la Cruz, Spain (26 Sep 1988).

The asymptotic properties of the low-degree solar gravity modes classified by Hill and Gu are studied in the framework of first- and second-order asymptotic theory predictions. The results of this analysis demonstrate the necessity of retaining the second-order term in asymptotic theory to describe the eigenfrequency spectrum. In this theory, there are two first-order parameters, T_0 and δ, and two second-order parameters, V_1 and V_2. Values of the parameters obtained in this analysis are: T_0 = 36.31 +- 0.12 min, δ = {minus}0.43 +- 0.13, V_1 = 0.35, and V_2 = 4.76. There remain differences of ~0.3 μHz between the asymptotic theory eigenfrequencies and observed eigenfrequencies which are quasi-periodic functions of the radial order n for a given value of the degree {ell}. 26 refs., 1 fig., 1 tab.

6546 (FNAL/C—88/85-A) Cosmic strings. Bennett, D.P. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1988. Contract AC02-76CH03000. 14p. (CONF-8805224—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE88017199/JAW.

From Workshop on current status of cosmic strings; New Haven, CT, USA (5 May 1988).

Cosmic strings are linear topological defects that are predicted by some grand unified theories to form during a spontaneous symmetry breaking phase transition in the early universe. They are the basis for the only theories of galaxy formation aside from quantum fluctuations from inflation that are based on fundamental physics. In contrast to inflation, they can also be observed directly through gravitational lensing and their characteristic microwave background anistropy. It has recently been discovered by F. Bouchet and myself that details of cosmic string evolution are very different from the so-called "standard model" that has been assumed in most of the string induced galaxy formation calculations. Therefore, the details of galaxy formation in the cosmic string models are currently very uncertain. 29 refs., 9 figs.

6547 **(FRCEA-TH—95) CCD fitted to the UV Prime spectrograph: Performance Astronomical telescope.** Boulade, O. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF); Paris-7 Univ., 75 (France)). Oct 1986. 197p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88756140/JAW.

A CCD camera was fitted to the 3.6 m French-Canadian telescope in Hawai. Performance of the system and observations of elliptic galaxies (stellar content and galactic evolution in a cluster) and quasars (absorption lines in spectra) are reported. In spite of its resolution being only average, the extremely rapid optics of the UV spectrograph gives good signal to noise ratios enabling redshifts and velocity scatter to be calculated with an accuracy better than 30 km/sec.

6548 **(FRCEA-TH—106) Massive stars with mass loss: Evolution, nucleosynthesis, and astrophysical implications.** Prantzos, N. (Paris-7 Univ., 75 (France)). Jun 1986. 249p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88756141/JAW.

Evolution and nucleosynthesis of mass loss WR stars is studied, particularly evolution of stars with initial mass between 50 and 100 solar masses, during combustion of H and He. A semi-empirical mass loss formalism, the Roxburgh criterion for convection, and nuclear data are used. Composition of the stellar surface and ejecta (and ejecta contribution to cosmic ray composition) are derived. The contribution of these stars to s elements in our solar system is shown. Their production of /sup 26/Al is compared to the quantity in the galaxy. Gamma ray emission at 1.8 MeV from the decay of this radionuclide is estimated in galactic longitude. The stars evolve as 0 and 0f stars during H combustion and spend 20% of their He combustion period as WN stars and 80% as WC-W0. Evolution always occurs in the blue part of the HR diagram, and satisfies observational constraints on its upper part.

6549 **(ICR—161-88-7) Search for TeV gamma rays from SN1987A during December 1987 and January 1988.** Bond, I.A.; Conway, M.J.; Budding, E. and others. (Auckland Univ. (New Zealand). Dept. of Physics). (Tokyo Univ., Tanashi (Japan). Inst. for Cosmic Ray Research). Apr 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755493/JAW.

Very high energy γ rays from the supernova SN1987A were searched for at the Black Birch Range in New Zealand during December 1987 and January 1988. The total data obtained during 42 hours of observation time give an upper bound on the flux at 95 % confidence level of 6.1 x 10/sup -12/ cm/sup -2/ s/sup -1/ for γ rays with energies larger than 3 TeV. Data obtained on January 14 and 15 are found to have excess counts, above the background level, corresponding to a flux of (1.9 +- 0.5) x 10/sup -11/ cm/sup -2/ s/sup -1/. The energy emitted in TeV γ rays, by attributing this excess to γ rays from SN1987A, is calculated {similar←to}10/sup 43/ erg assuming that the duration of the excess was 2 {similar←to}3 days. PACS numbers: 97.60.Bw, 95.85.Qx.

6550 (INIS-SU—43, pp 22-23) **On a mechanism of regulation of solar wind mass flow.** Chashej, I.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

It is shown that the maximum possible value of solar wind mass flow is defined by the balance between heat-conductive and gravitational energy flows. Regulation of solar wind mass flow takes place in the external corona. 4 refs.

6551 (JINR—D-2-87-123, pp 375-394) **Renormgroup analogies in astrophysics.** Mnatsakanyan, M.A. (AN Armyanskoj SSR, Byurakan. Astrofizicheskaya Observatoriya; Erevanskij Gosudarstvennyj Univ. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

New semigroup relations describing solutions of nonstaionary nonlinear problems of the radiation transfer theory are established. They lead to an effective apparatus of analysis, different from classical ones, even in stationary and linear cases. Advantages of the semigroup apparatus are discussed. The role of the Ambarzumyan invariance principle and relation with the Shirkov functional self-similarity is stated. A wide variety of mathematical analogies with the renormalization group and problems of the quantum field theory is established. On the basis of these analogies an attempt is made to transpose some physical conclusions from one theory into another. An astrophysical example of the inverse problem of determination of the stellar flare frequency distribution function in aggregates is discussed. A possibility of using the semigroup approach in the problem of stellar system dynamics is noted. the studies of other authors on application of the renormalization group approach to astrophysical problems are observed. The semigroup approach foreruns new possibilities of effective study, in particular, by analog simulation and borrowing of methods and results. 24 refs.; 2 figs.

6552 (KEK—87-26, pp 1-12) **Primordial nucleosynthesis, solar neutrino and neutron lifetime.** Terasawa, Nobuo. (Tokyo Univ. (Japan). Faculty of Science). Jan 1988. NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780028/JAW. (CONF-8711247—).

From 1. workshop on the neutron lifetime; Oho, Japan (19 Nov 1987).

Primordial nucleosynthesis and the solar neutrino problem are reviewed with relation to the neutron lifetime. Ambiguities of the theoretical predictions arising due to the uncertainty of the neutron lifetime is summarized quantitatively. In primordial nucleosynthesis, the uncertainty in the neutron lifetime seriously affects the predictions and preecesions within 1 % are required for definite predictions. If error analyses are sufficient, precisions up to 2 % are acceptable.

6553 **(RRK—88-12) Monopoles and magnetic fields in the inflationary universe.** Sasaki, Misao. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Apr 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755532/JAW.

We discuss the cosmological implications of monopoles which have multiple units of the Dirac charge, are relatively light compared with the grand unified mass scale, and which do not catalyze nucleon decay. Combined with the inflationary universe scenario, though admittedly model-dependent, we find the monopole condensation can occur during the inflationary stage and these monopoles can excite the magnetic current on large spatial scales and give rise to primordial magnetic fields of an appreciable strength. We also find the present density of residual monopoles can be such that it gives the flux which is just below the bound based on the persistence of the galactic magnetic field.

6554 **(RRK—88-13) Isotropization of the cosmic background radiation due to galactic gravitational screening.** Tomita, Kenji. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Apr 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755533/JAW.

The primordial objects with the masses of galaxies or their clusters formed at early stages such as $z > 10$ can play a powerful role of gravitational lenses and their random multiple scattering brings an effective screening for the cosmic background radiation. In a cold-dark-matter dominant model with the white-noise spectrum of initial density perturbations, it is shown that, if the primordial objects with the masses 10/sup 12/h/sup -1/ (solar mass) are in the nonlinear stage at the epochs $1 + z = 10$ {similar←to}20, the objects with 6 x 10/sup 14/h/sup -1/ (solar mass) are in the nonlinear stage at $1 + z = 6.3$ {similar←to}14, and accordingly the small-scale anisotropy of the radiation may be smoothed-out within 13 {similar←to}28 minutes by this gravitational screening, where the Hubble constant H/sub o/ = 100 h km s/sup -1/ Mpc/sup -1/.

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 7099

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 6207, 6236, 6242, 6892

6555 (CEA-CONF—9531) Study of the multiple exchange frequencies by measurements of pressure as a function of the polarization of BCC solid 3He samples. Bernier, M.E.R.; Suaudeau, E.; Roger, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique du Solide et de Resonance Magnetique). Jun 1988. 4p. (CONF-8806284—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755611/JAW.

From Conference on spin polarized quantum systems; Torino, Italy (20 Jun 1988).

We deduced the characteristic frequencies of atomic exchange of two, three and four atoms in solid 3He by measuring the contribution of these exchanges to the pressure of the solid at high spin polarization where this contribution becomes significant i.e. in a low temperature and high magnetic field range.

6556 (CONF-881002—29) Molecular two-photon spectroscopy. McCann, M.P.; Chen, C.H.; Payne, M.G. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004167/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Two-photon transitions are examined in molecular oxygen in the region of 8 to 9 eV. Using a pulsed nozzle-quadrupole mass spectrometer apparatus, absolute two-photon constants can be determined. 5 refs., 2 figs.

6557 (CONF-881002—30) Two-photon resonant, stimulated processes in krypton and xenon. Miller, J.C. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004165/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Both on-axis and conical emissions have been observed following two-photon pumping of the 5p states of krypton and the 6p', 7p, 8p, and 4f states of xenon. In the former case, coherent emissions from the 5p states to the 5s are observed, and in the latter case, many p→s, d→p, and f→d cascade emissions are observed. By analogy to the well-studied alkali and alkaline earth examples, the emissions are discussed in terms of amplified spontaneous emission (ASE), stimulated hyper-Raman scattering, and parametric four-wave mixing. The physical processes responsible for the conical emission and for intensity anomalies in the xenon p→s emissions are not understood at present. Interference effects due to coherent cancellation between competing excitation pathways may be occurring. 4 refs., 3 figs.

6558 (DOE/ER/13191—9) Kinetic studies following state-selective laser excitation: Progress report, March 15, 1988--March 14, 1989. Keto, J.W. (Texas Univ., Austin (USA). Dept. of Physics). Nov 1988. Contract FG05-84ER13191. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003699/JAW.

The objective of this contract is the study of state-to-state, electronic energy transfer reactions following two-photon laser excitation. We have chosen to study reactions of Xe $5p^5np$ because of their relevance to the XeCl excimer laser. We are studying deactivation reactions in collisions with heavy atoms such as Ar, Kr, and Xe and reactive collisions with chlorides. The reactants are excited by multiphoton laser absorption. Product channels are observed by their fluorescence, or by laser induced fluorescence using a second color laser. Reaction rates are measured by observing the time dependent decay of signals from reactant and product channels. In addition we measure interaction potentials of the reactants by laser spectroscopy where the laser induced fluorescence or ionization is measured as a function of laser wavelength (excitation spectra) or by measuring fluorescence spectra at fixed laser frequencies with monochromators. The spectra are obtained in the form of either lineshapes or individual lines from rovibrational transitions of bound states. 11 refs. 4 figs., 3 tabs.

6559 (DOE/ER/13440—6) Hyperspherical coordinate theory of two-electron processes: Final report for the period 1 August 1985--31 July 1988. Macek, J.; Starace, A.F. (Nebraska Univ., Lincoln (USA). Dept. of Physics and Astronomy). 1988. Contract FG02-85ER13440. 14p. NTIS, PC A03 - OSTI. Order Number DE89003823/JAW.

The main focus of our project has been electron correlations in atoms using methods based on hyperspherical coordinates. Our aim has been primarily to lay the ground work for state-of-the-art calculations employing hyperspherical coordinates. In addition, we have made applications to specific atomic collision processes in those cases where a hyperspherical coordinate point of view can make a significant contribution to our understanding of the physical mechanism involved. Projects directed toward state-of-the-art calculations are discussed and specific applications are described. 15 refs., 2 figs.

6560 (DOE/ER/13492—1) Energy partitioning in elementary gas phase reactions: Progress report, March 1, 1986--August 31, 1988. Bersohn, R. (Columbia Univ., New York (USA). Dept. of Chemistry). 1988. Contract FG02-86ER13492. 14p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003799/JAW.

During the last 2 1/2 years we: (1) Measured the cross sections of the reactions (H + D{sub 2} = HD + D, H + HD = H{sub 2} + D) as a function of relative translational energy in the range 1 to 3 eV. (2) Measured the cross sections and translational energy release in exchange reactions with 1.1 eV H atoms (H + DCCD = D + HCCD, H + CH{sub 3}CCD = CH{sub 3}CCH + D, H + C{sub 2}D{sub 4} = C{sub 2}D{sub 3}H + D, H + CD{sub 3}CDCD{sub 2} = CD{sub 3}CDCDH + D). (3) Starting with fairly monoenergetic 2.5 eV H atoms the evolution of their velocity distribution was studied as a function of pressure of the rare gases, O{sub 2} and N{sub 2}. (4) Measured the rate of dissociation of monoenergetically excited methylaromatics into benzyl radicals and hydrogen atoms and also kinetic energy distribution of the latter. (5) In a series of studies on HN{sub 3} and NH(a{sup 1}{Delta}) it was found (a) the quantum yield at 248 nm of the reaction HNNN + h{nu} = H + NNN is 0.38; (b) the translational energy release and rate constant were measured for the reaction NH(a) + D{sub 2} = NHD + D; and (c) in the quenching process NH(a{sup 1}{Delta}) + Xe = NH(X{sup 3}{Sigma}) + Xe the energy release is almost entirely into translation. (6) Measured the state distribution of the CN product of reactions (H + HCN = H{sub 2} + CN, F + HCN = HF + CN, H + ClCN = HCl + CN, and the isotopic ratio of the reaction CN + HD = H(D) + HCN(DCN)). (7) Measured the state distribution of the CN radicals dissociated from phenyl cyanide and phenyl isocyanide at 193 nm. (8) Measured the hydrogen atom kinetic energy and isotope effects in the dissociation of methanol excited by light or by a chemical reaction. 12 refs., 3 figs.

6561 (DOE/ER/13849—1) Low energy ion-molecule reactions and chemiionization kinetics: Progress report, February 1, 1988--January 31, 1989. Farrar, J.M. (Rochester Univ., NY (USA)). [1988]. Contract FG02-88ER13849. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89002252/JAW.

Our research program is devoted to understanding the dynamics of elementary ionic collisions at the level of the underlying potential surface by measuring energy and angular distributions of reactively scattered produce with crossed beam methods over the relative center-of-mass energy range from 0.3 to 3 eV. Over the past several years we have emphasized reactions of positive ions relevant to combustion, especially C^+ reactions with polar molecules and hydrocarbons. We have measured product kinetic energy distributions and from them have inferred pathways of energy disposal into product internal degrees of freedom. In the first part of this report, we summarize our most recent efforts in this area. This

work represents the end of our experiments in which we use electrostatic energy analysis of the reaction products as the diagnostic of energy disposal in these systems. The second part of this report describes our progress to date on a new series of experiments on anions, specifically O/sup {minus}/, in which product state analysis is performed state specifically by laser multiphoton ionization (MPI) as a function of collision energy. The reactions we will study include particle transfer and electron detachment systems, and the use of sensitive laser probes provides a very detailed assessment of reaction dynamics.

6562 (GSI—88-35(prepr.)) **Monoenergetic (e/sup +/e/sup -/) pairs from heavy-ion collisions.** Berdermann, E.; Bosch, F.; Kienle, P.; Koenig, W.; Kozhuharov, C.; Tsertos, H.; Schuhbeck, S.; Huchler, S.; Kemmer, J.; Schroeter, A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik). Jul 1988. 15p. (CONF-8806117—). Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

From 3. international conference on nucleus nucleus collisions; Saint-Malo, France (6 Jun 1988).

Energy and angular correlations of (e/sup +/e/sup -/) pairs emitted in HI collisions were investigated. Some evidence is found for a weak peak at (815+-5) keV in the (e/sup +/e/sup -/) sum-energy spectrum obtained for θsub(e/sup +/e/sup -/) = 180/sup 0/+-18/sup 0/ (FWHM). The peak energy is consistent with previous observations.

6563 (INIS-SU—68, pp 258) **Calculation of electric field gradient in nuclei of molecules by the Hartree - Fock - Rutan method.** Gusejnov, I.I.; Mursalov, T.M.; Sadykhov, F.S.; Pashaev, F.G. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6564 (INIS-SU—68, pp 268) **Vacuum polarization by strong Coulomb field and its contribution to multicharged ion spectra.** Manakov, N.L.; Nekipelov, A.A.; Fajnshtejn, A.G. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6565 (INIS-SU—68, pp 271) **K - Auger spectrum.** Babenkov, M.I.; Zhdanov, V.S.; Starodubov, S.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6566 (INIS-SU—68, pp 272) **Effects of p/sub 1/2/ and p/sub 3/2/ level mixing in hyperfine structure of light muonic atom spectra.** Trofimenko, E.E. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6567 (INIS-SU—68, pp 273) **Meson exchange second-class currents in the μ/sup -/ capture processes by light nuclei.** Katkhat, Ch.L. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6568 (INIS-SU—68, pp 255) **Polarization - angular dependence of cross section of γ quanta scattering by bound electron.** Manakov, N.L.; Nekipelov, A.A.; Fajnshtejn, A.G. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6569 **(LAL—87-54) Study of the Three and four photon final states produced in e/sup +/e/sup -/ annihilation at 35 ≦ √s ≦ 46.8 GeV.** ; CELLO Collaboration. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Nov 1987. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756160/JAW.

The reactions e/sup +/e/sup -/ -> γγγ and e/sup +/e/sup -/ -> γγγγ have been studied at center of mass energies between 35 and 46.8 GeV with an integrated luminosity of about 130 pb/sup -1/ accumulated with the CELLO detector at PETRA. The measurements are compared to QED calculations up to 3rd and 4th orders of perturbation theory. Excellent agreement is observed.

6570 **(ORNL/M—672) HISTRAP: Proposal for a Heavy Ion Storage Ring for Atomic Physics.** (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 293p. NTIS, PC A13/MF A01 - OSTI. Order Number DE89004298/JAW.

This paper presents an overview of the physics capabilities of HISTRAP together with a brief description of the facility and a sampling of the beams which will be available for experimentation, and surveys some of the lines of investigation in the physics of multicharged ions, molecular ion spectroscopy, condensed beams, and nuclear physics that will become possible with the advent of HISTRAP. Details of the accelerator design are discussed, including computer studies of beam tracking in the HISTRAP lattice, a discussion of the HHIRF tandem and ECR/RFQ injectors, and a description of the electron beam cooling system. In the past three years, HISTRAP has received substantial support from Oak Ridge National Laboratory management and staff. The project has used discretionary funds to develop hardware prototypes and carry out design studies. Construction has been completed on a vacuum test stand which models 1/16 of the storage ring and has attained a pressure of 4×10^{-12} Torr; a prototype rf cavity capable of accelerating beams up to 90 MeV/nucleon and decelerating to 20 keV/nucleon; and a prototype dipole magnet, one of the eight required for the HISTRAP lattice. This paper also contains a summary of the work on electron cooling carried out by one of our staff members at CERN. Building structures and services are described. Details of cost and schedule are also discussed. 77 refs.

6571 **(SAND—88-2594) Atomic orbital data for elements with atomic numbers 1 ≦ Z ≦ 103.** Kerley, G.I. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 133p. NTIS, PC A07 - OSTI. Order Number DE89003999/JAW.

Atomic orbital energies and radial expectation values are tabulated for the ground state electronic configuration of all elements with Z ≦ 103 and for all orbitals having principal quantum numbers n ≦ 8. These tables have been developed for use in a model of electronic excitation and ionization that requires orbital data for both the occupied and unoccupied orbitals. The wavefunctions were calculated by the Dirac-Hartree-Fock-Slater method, with a local exchange potential due to Liberman. This potential has the Coulombic form at large distances from the nucleus, with the result that both the occupied and unoccupied orbitals are bound states. The complete nonlocal exchange expression was used to compute the orbital energies. The results are in good agreement with full Dirac-Hartree-Fock calculations for the occupied orbitals. 22 refs., 2 tabs.

6572 **(UCRL—99799) Recent advances in atomic modeling.** Goldstein, W.H. (Lawrence Livermore National Lab., CA (USA)). 12 Oct 1988. Contract W-7405-ENG-48. 13p. (CONF-8808164—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002902/JAW.

From International Astronomical Union colloquium 115; Cambridge, MA, USA (22 Aug 1988).

Precision spectroscopy of solar plasmas has historically been the goad for advances in calculating the atomic physics and dynamics of highly ionized atoms. Recent efforts to understand the laboratory plasmas associated with magnetic and inertial confinement fusion, and with X-ray laser research, have played a similar role. Developments spurred by laboratory plasma research are applicable to the modeling of high-resolution spectra from both solar and cosmic X-ray sources, such as the photoionized plasmas associated with accretion disks. Three of these developments in large scale atomic modeling are reviewed: a new method for calculating large arrays of collisional excitation rates, a sum rule based method for extending collisional-radiative models and modeling the effects of autoionizing resonances, and a detailed level accounting calculation of resonant excitation rates in FeXVII. 21 refs., 5 figs., 2 tabs.

6573 **(UCRL—99923) Electronic excited states in conjugated polymers.** Mazumdar, S.; Dixit, S.N. (Lawrence Livermore National Lab., CA (USA); Los Alamos National Lab., NM (USA)). Oct 1988. Contract W-7405-ENG-48. 6p. (CONF-880669—25). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003896/JAW.

From International conference on science and technology of synthetic metals; Santa Fe, NM, USA (26 Jun 1988).

We re-examine the subgap neutral and charged soliton absorptions in polyacetylene and the 2^1A_g state in finite polyenes within the context of a simple Peierls-Hubbard model. Our motivation is to determine the origin of the optical gap in trans-polyacetylene and to determine the magnitude of the effective on-site Coulomb repulsion. We conclude that this term lies between $2.25t_0$ and $2.75t_0$, where t_0 is the nearest neighbor one-electron hopping integral. 21 refs., 2 figs.

6574 **Split-operator spectral method for solving the time-dependent Schroedinger equation in spherical coordinates.** Hermann, M.R.; Fleck J.A. Jr. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **38**: No. 12, 6000-6012(15 Dec 1988).

A spectral method previously developed for solving the time-dependent Schroedinger equation in Cartesian coordinates is generalized to spherical polar coordinates. The solution is implemented by repeated application of a unitary evolution operator in symmetrically split form. The wave function is expanded as a Fourier series in the radial coordinate and in terms of Legendre functions in the polar angle. The use of appropriate quadrature sets makes the expansion exact for band-limited functions. The method is appropriate for solving explicitly time-dependent problems, or for determining stationary states by a spectral method. The accuracy of the method is established by computing the Stark shift and lifetime of the 1s state in hydrogen, the low-lying energy levels for hydrogen in a uniform magnetic field, and the 2p-nd dipole transition spectrum for hydrogen.

6575 **Theoretical study of the negative ions of HBr and HI.** Chapman, D.A.; Balasubramanian, K.; Lin, S.H. (Department of Chemistry, Arizona State University, Tempe, Arizona 85287-1604). *Physical Review [Section] A: General Physics;* **38**: No. 12, 6098-6106(15 Dec 1988).

Relativistic-configuration-interaction (RCI) and complete-active-space (CAS) multiconfiguration self-consistent-field (MCSCF)/CI calculations are performed for the low-lying anion states of HBr^- and HI^-. At both the RCI and CASSCF/CI levels of theory, the $^2\Sigma^+$ anion states are found to be repulsive in the Franck-Condon regions of the HX $^1\Sigma^+$ states and bound relative to the $H+X^-$ asymptotes at $r > r_e$ of the parent neutral states. The HI molecule is predicted to have a slightly positive adiabatic electron affinity, and electron attachment in this system is considered in a Langevin model. Electronic transition moments between the $^2\Sigma_{1/2}^+$ and $^2\Pi_{1/2}$ states of HBr^- and HI^- are calculated in order to examine the origins of nonadiabatic H^- fragment production observed in dissociative-attachment experiments on HBr.

6576 **Effect of Coster-Kronig transition on dielectronic recombination of the He-like ions.** Chen, M.H. (High Temperature Physics Division, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **38**: No. 12, 6430-6432(15 Dec 1988).

Dielectronic recombination rate coefficients have been calculated for He-like ions with atomic numbers Z = 5, 6, 7, 8, and 9. The calculations include the influence of the Coster-Kronig channels to the excited states of the recombining ion on the rate coefficients. The detailed Auger and radiative rates were calculated using the multiconfiguration Dirac-Fock model in intermediate coupling with configuration interaction. The total dielectronic recombination coefficients for B/sup 3+/, N/sup 5+/, and F/sup 7+/ ions have been found to reduce by 60%, 13%, and 4%, respectively, due to the inclusion of Coster-Kronig channels. For the B/sup 3+/ ion, the dielectronic recombination coefficient from the present work is smaller than the value derived from the Burgess-Merts formula by a factor of 3 at electronic temperature T = 100 eV.

6577 **Cusp-electron production in pure-target-ionization and transfer-ionization events for 0.1-MeV/u I/sup 13+/ projectiles on He and H_2 targets.** Underwood, T.A.; Breinig, M.; Gaither C.C. III; Freyou, J. (Department of Physics, University of Tennessee, Knoxville, Tennessee 37996-1200). *Physical Review [Section] A: General Physics;* **38**: No. 12, 6138-6142(15 Dec 1988).

Cross sections for production of electrons which are moving with near-zero velocity in the projectile frame in pure-target-ionization and transfer-ionization events were measured for 12.7-MeV I/sup 13+/ ions incident on He and H_2 gas targets. These cusp-electron-production cross sections were found to be nearly equal for pure-target-ionization and transfer-ionization events in both targets. The cross section for cusp-electron production in transfer ionization from He targets comprised only 0.04% of the total transfer-ionization cross section and in pure target ionization comprised only 0.12% of the total pure-target-ionization cross section. Similar results were obtained for H_2 targets except that all respective cross sections were larger than for He. The experiment shows that most of the free electrons released in pure-target- and transfer-ionization events for 0.1-MeV/u I/sup 13+/ incident on He and H_2 gas targets are not low-energy electrons in the projectile frame.

6578 **Ionization of helium by fast, highly charged projectiles.** Ben-Itzhak, I.; McGuire, J.H. (James R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, Kansas 66506). *Physical Review [Section] A: General Physics;* **38**: No. 12, 6422-6423(15 Dec 1988).

Both single and double ionization of helium by projectiles of charge q ranging up to 50 are considered at collision velocities corresponding to 1.4 MeV/amu within the independent-electron approximation. A simple calculation using a unitarized semiclassical Coulomb approximation probability is sufficient to provide agreement with the charge dependence of observed total cross sections.

6579 **Coherence and correlation in doubly excited heliumlike atoms.** Burgdoerfer, J.; Morgenstern, R. (Department of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37996). *Physical Review [Section] A: General Physics;* **38**: No. 11, 5520-5538(1 Dec 1988).

We analyze properties of the density matrix of doubly excited two-electron systems formed in inelastic collisions. Formulas for the two-particle joint angular probability density, the angular correlation function, and the reduced single-particle density are derived. Of particular interest is the interplay between the intrinsic correlations of the stationary two-electron state and collisionally induced coherences. We focus on its effects on the correlated and single-particle motion of the electrons. If one chooses approximate stationary wave functions reflecting the approximate O(4) x O(4)⊃(4) dynamical symmetry, a simple quasiclassical interpretation of coherence and correlation in terms of shapes and modes of the relative motion of Kepler orbits can be given. The present description is applied to recent experimental results by Van der Straten and Morgenstern [Comments At. Mol. Phys. 19, 243 (1986)].

6580 **Effects of electric fields on the photodetachment cross section of the H^- ion near threshold.** Stewart, J.E.; Bryant, H.C.; Harris, P.G.; Mohagheghi, A.H.; Donahue, J.B.; Quick, C.R.; Reeder, R.A.; Yuan, V.; Hummer, C.R.; Smith, W.W.; and others. (The University of New Mexico, Albuquerque, New Mexico 87131). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 11, 5628-5638(1 Dec 1988).

A study is presented of the photodetachment cross section of the H^- ion near the one-electron threshold in electric fields ranging from approximately 5 x 10/sup -7/ up to 2.4 x 10/sup -4/ a.u. The lowest-field data, nominally at zero field, are consistent with the Wigner threshold law for p-wave processes. At larger field values, photodetachment using σpolarized laser light displays the expected lowering of apparent threshold and evidence of tunneling. Using π-polarized light, the same features are seen with the additional feature of oscillations superimposed on the cross section. Three complementary explanations are presented for the oscillations.

6581 **Low-energy electron drift and scattering in krypton and xenon.** Hunter, S.R.; Carter, J.G.; Christophorou, L.G. (Atomic, Molecular, and High Voltage Physics Group, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831-6122). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 11, 5539-5551(1 Dec 1988).

The drift velocity of electrons in Ar, Kr, and Xe has been measured at a gas temperature T = 301 K using gas pressures of 300 and 600 kPa over the E/N range 2 x 10/sup -20/≦/N≦ x 10/sup -17/ V cm². The measurements have been used to derive the low-energy momentum-transfer cross section σsub m/(epsilon-c) in Kr and Xe at electron energies up to 8 eV using a Boltzmann-equation analysis along with a four-parameter modified-effective-range-theory procedure. Particular attention has been paid to the effects of impurities on the measured electron drift velocities and the uniqueness of the derived momentum-transfer cross sections. The present measurements and calculated cross sections are compared with published values from experiments and calculations.

6582 **Electron loss from helium atoms by collisions with fully stripped ions.** Wetmore, A.E.; Olson, R.E. (Department of Physics and Laboratory for Atomic and Molecular Research, University of Missouri--Rolla, Rolla, Missouri 65401-0249). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 11, 5563-5570(1 Dec 1988).

Electron-loss cross sections have been calculated for fully stripped ions with charge states +1 to +100 colliding with helium atoms in the energy range 100--1000 kev/amu. The classical-trajectory Monte Carlo method was used along with a model of the helium atom with two active electrons. The reactions studied were single and double ionization, single- and double-electron capture, and electron capture plus ionization. Cross sections for the single-electron-removal reactions agree well with experimental data. Double-electron-removal cross sections are in qualitative agreement with experimental results. The n-level distributions following electron capture show that the electron-capture--plus--ionization and double--electron-capture processes are peaked at a lower n level relative to single-electron capture.

6583 **Relativistic calculations of dielectronic recombination rate coefficients for Be-like ions.** Chen, M.H.; Crasemann, B. (High Temperature Physics Division, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 11, 5595-5601(1 Dec 1988).

The dielectronic recombination rate coefficients for the ten initial states of the $1s^22l2l'$ configurations of the Be-like ions have been calculated for six ions with atomic numbers Z = 30, 34, 36, 42, 47, and 54 in the isolated-resonance approximation. The detailed Auger and radiative rates for each autoionizing state were evaluated using the multiconfiguration Dirac-Fock model in intermediate coupling with configuration interaction. The present results are compared with the existing theoretical values and the predictions of the Burgess and the Burgess-Merts semiempirical formulas.

6584 **Pseudospectral techniques in minimum-variance calculations of electron-scattering cross sections.** Rescigno, T.N.; McCurdy, C.W.; Schneider, B.I. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 11, 5921-5924(1 Dec 1988).

We propose a method for calculating electron-scattering cross sections which consists of a combination of the minimum-variance approach to optimizing a trial wave function and pseudospectral techniques for evaluating exchange contributions. Tests in simple applications indicate that this hybrid approach is remarkably efficient. Only one-electron matrix elements and quantities depending on the trial function and its derivatives evaluated at grid points are required. The extension to more complex systems is discussed.

6585 **Some forbidden lines of platinum.** Engleman R. Jr.; Cowan, R.D.; Peek, J.M. (Chemical and Laser Sciences Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of the Optical Society of America B: Optical Physics;* **5**: No. 11, 2294-2297(Nov 1988).

A detailed examination of a high-resolution Fourier-transform spectrum of a platinum hollow-cathode discharge in the near infrared has yielded one Pt I and four Pt II parity-forbidden magnetic dipole transitions. Theoretical calculations and analysis of the hyperfine structure are used to confirm these assignments, and applications to astrophysics and lasers are suggested.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 6684

6586 **(FRNC-TH—3326) Theory of magnetostatic equilibria and applications in astrophysics.** Amari, T. (Paris-6 Univ., 75 (France)). Apr 1988. 258p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756145/JAW.

Magnetohydrostatic equations are used to study the properties of magnetic configurations of astrophysical interest, particularly in solar physics. Results on force-free solutions with singularities (with current sheets) and on solutions which take into account current sheets and gravitational fields are obtained. A general method to construct an infinite class of non-y-symmetric models of protuberances when the magnetic field of the support is assumed to be potential is outlined. The general integral properties of current sheets of arbitrary geometry plunged into a nonlinear force-free magnetic field are established. It is shown that for a given mass, the equilibrium height of the protuberance increases with the shear of the force-free field. The case where the current sheet is reduced to a filament is examined. It is also shown that there exists a critical pressure beyond which no equilibrium is possible.

6587 **(SUDAAR—567) Instantaneous three-dimensional optical tomographic measurements of species concentration in a co-flowing jet.** Snyder, R. (Stanford Univ., CA (USA). Dept. of Aeronautics and Astronautics). Mar 1988. Contract FG03-85ER13312. 117p. Ray Snyder, Stanford University, Stanford, CA 94305. Order Number TI89003690/JAW.

Many optical techniques have been developed recently for multi- dimensional measurements in fluid flows. Unfortunately, few are applicable when full three-dimensional measurements are desired without spreading the measurements out over a long time. This thesis discusses the tomographic method and presents interferometric tomographic measurements of species concentration measured instantaneously (in 300μs). The measurements are of a Reynolds number 2800 co-flowing jet of neutrally buoyant argon-helium flowing into air. Resolution of these measurements is approximately 1.3 mm. 53 refs., 57 figs.

6588 **Shear viscosity of the Lennard-Jones fluid near the triple point: Green-Kubo results.** Erpenbeck, J.J. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 12, 6255-6266(15 Dec 1988).

The long-standing disagreement over the shear viscosity coefficient of the Lennard-Jones fluid near the triple point is reexamined through a series of very extensive Monte Carlo molecular-dynamics calculations of this transport coefficient based on the Green-Kubo theory. The stress autocorrelation function is shown to exhibit a slow decay, principally in the kinetic-potential and the potential-potential terms, which is large compared with the kinetic-kinetic long-time tail predicted by simple mode-coupling theory. Nonetheless, the viscosity coefficient, exclusive of any correction for this tail for times greater than are accessible numerically, is found to agree with that of Schoen and Hoheisel (who discounted the existence of such a tail) as well as nonequilibrium molecular-dynamics calculations. The large value of the viscosity coefficient found by Levesque and co-workers for 864 particles is brought into statistical agreement with the present results by a modest, but not unrealistic, increase in its statistical uncertainty. The pressure is found to exhibit an anomalous dependence on the size of the system, but the viscosity as well as the self-diffusion constant appear to be linear in the inverse of the number of particles, within the precision of our calculations. The viscosity coefficient, including a long-time-tail contribution based on the extended mode-coupling theory is (3.796 +- 0.068)σepsilon-c/m)/sup 1/2/ for the Lennard-Jones potential, fitted to a cubic spline, and (3.345 +- 0.068)σepsilon-c/m)/sup 1/2/ for the potential truncated at 2.5σ

6589 **Perturbation theory of a classical one-component plasma.** Lee, J.W.; Ree, F.H. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550).

We have extended a recent perturbation theory [J. Chem. Phys. 82, 414 (1985); 84, 4547 (1986)] for nonionic systems to the one-component plasma (OCP). Characteristic features of the theory are its ability to handle both fluids and solids and the use of a reference potential whose repulsive range shrinks with density. Based on the computed thermodynamic data, we have developed a simple alternative (optimized hard-sphere) model, whose Helmholtz free energy is a sum of the Helmholtz free energy of the hard-sphere reference system and the Madelung energy of a fcc lattice. Comparison with available Monte Carlo and other theoretical results shows that the optimized hard-sphere model gives reliable solid (fcc) and fluid properties. The theory predicts that the fcc solid will melt at the Coulomb coupling parameter Γsub m/ = 208 versus Helfer et al.'s [J. Stat. Phys. 37, 577 (1984)] Monte Carlo value of 196. This difference is due to a small difference (0.1%) in the computed excess free energy. The computed internal energy can be accurately fitted by an analytic form. Its two leading terms (for the fluid) are -0.899488Γ1.272 97Γsup 1/4/, in close agreement with Slattery et al.'s [Phys. Rev. A 21, 2087 (1980); 26, 2255 (1982)] empirical fit to their Monte Carlo data. We conclude that the hard-sphere perturbation theory is applicable to a long-range repulsive system, such as the OCP, so long as the hard-sphere diameter is judiciously chosen by using a density-dependent reference potential.

6590 **Spectrum and the stability of the Chebyshev collocation operator for transonic flow.** Fishelov, D. (4 Physikalisches Institut, Universitaet Stuttgart, Pfaffenwaldring 57, D 7000 Stuttgart 80, West Germany). *Mathematics of Computation;* **51**: No. 184, 559-579(Oct 1988).

The extension of spectral methods to the small disturbance equation of transonic flow is considered. It is shown that the real parts of the eigenvalues of its spatial operator are nonpositive. Two schemes are considered; the first is spectral in the x and y variables, while the second is spectral in x and of second order in y. Stability for the second scheme is proved. Similar results hold for the two-dimensional heat equation.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 6305, 7167

6591 **(DOE/ER/40146—1) [Medium high energy physics at Syracuse University]: Technical progress report.** (Syracuse Univ., NY (USA). Dept. of Physics). [1988]. Contract FG02-84ER40146. 34p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003520/JAW.

The Syracuse University Medium Energy Physics Group, which consists of a faculty member, two graduate students, and a research associate, is actively engaged in the program of research described in this document. During the past year we have obtained the first high-quality data on our experiment to measure the electroweak interference effect in the scattering of polarized electrons from carbon nuclei. Our first preliminary result, based on about 15 hours of beam on target, is a raw asymmetry of A = 0.6 +- 0.7 ppM. This result is consistent with the prediction of the Standard Model of the electroweak interactions and has a statistical error of about the size of the expected effect. The experiment has been done at the MIT-Bates Linear Accelerator Center in collaboration with CCNY, Harvard, MIT, and Yale. We are also a member of a collaboration including MIT, Alberta, SACLAY, and WPI, which is measuring the tensor polarization of deuterons scattered by electrons. The bulk of the data was taken during this past year. Presently the analysis is in progress. Finally, we have completed the analysis of an experiment studying the charge states of muons leaving foils at low energies (0–20 keV). A detailed paper on this work has been prepared for publication. This complements an earlier paper devoted to the negative muonium ion. 5 refs.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 6656, 6657, 6990

6592 **(ANL-HEP-CP—88-35) Orbital angular momentum and parton spin densities.** Sivers, D. (Argonne National Lab., IL (USA). High Energy Physics Div.). 1988. Contract W-31109-ENG-38. 4p. (CONF-8806203—8). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003646/JAW.

From Symposium on future polarization at Fermilab; Batavia, IL, USA (13 Jun 1988).

The case for parton orbital angular momentum is considered in the light of the EMC data. 8 figs.

6593 **(BNL—41637) Investigation of resonance states in the glueball-enhanced channel {pi}{sup {minus}}p {yields} {phi}{phi}n.** Lindenbaum, S.J.; Foley, K.J.; Eiseman, S.E.; Etkin, A.; Hackenburg, R.W.; Longacre R.S.; Love, W.A.; Morris, T.W.; Platner, E.D.; Saulys, A.C.; Chan, C.; Kramer, M.A. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). 24 Jun 1988. Contract AC02-76CH00016;AC02-83ER40107. 9p. (CONF-8805142—29; CONF-880867—4). NTIS, PC A02/MF A01 - OSTI. Order Number TI88016741/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

In this paper we discuss the striking evidence for the g{sub T}(2010), g{sub T}{prime}(2300) and g{sub T}{prime}{prime}(2340) I{sup G}J{sup PC} = O{sup +}2{sup ++} resonances which comprise virtually all of the {pi}{sup {minus}}p {yields} {phi}{phi}n. The complete breakdown of the expected OZI suppression, and the striking differences of these states from conventional states and background in other channels have so far only been successfully explained by assuming they are produced by 1-3 2{sup ++} glueballs. The comparison with J/{psi} radiative decay results is made. The forthcoming search for an exotic J{sup PC} glueball is discussed. 7 refs., 5 figs., 1 tab.

6594 **(CERN-EP—88-101) Heavy-flavour production in UA1.** Ellis, N. (European Organization for Nuclear Research, Geneva (Switzerland); Birmingham Univ. (UK)). 23 Aug 1988. 17p. (CONF-8806232—3). NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89003190/JAW.

From 7. topical workshop on proton-antiproton collider physics; Batavia, IL, USA (20 Jun 1988).

Measurements of bottom production from the UA1 experiment are reviewed and compared with QCD in the transverse momentum range 5 GeV/c < p{sub T}{sup b} < GeV/c. The measurements are extrapolated using a QCD prediction for the shape of the different cross-section, d{sup 2}{sigma}/dp{sub T}dy, and the

total cross-section for bottom production is estimated. 15 refs., 10 figs., 2 tabs.

6595 (CERN-EP—88-103) Results on {Lambda}{sub c}{sup +}, D{sub s}{sup +}, D{sup 0} and D{sup +} decay properties from the NA32 experiment. Barlag, S.; Becker, H.; Boehringer, T.; Bosman, M.; Castillo, V.; Chabaud, V.; Damerell, C.; Daum, C.; Dietl, H.; Gillman, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Aug 1988. 23p. (CONF-880867—13). NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89003203/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

Results on the decay modes of the {Lambda}{sub c}{sup +} baryon and D{sub s}{sup +}, D{sup 0}, D{sup +} mesons and charge conjugates produced in 230 GeV {pi}{sup {minus}}Cu interactions are presented. A dedicated trigger for selection of {Lambda}{sub c}{sup +} {yields} pK{sup {minus}}{pi}{sup +}, D{sub s}{sup +} {yields} K{sup +}K{sup {minus}}{pi}{sup +} was used. A high resolution vertex detector consisting of charged coupled devices and silicon microstrip detectors allowed the selection of very clean samples of {Lambda}{sub c}{sup +} and D{sub s}{sup +}. We obtained as well a large sample of D{sup 0} and D{sup +}. In a preliminary analysis, a total of 1200 charmed particles in 20 different channels are fully reconstructed. Preliminary results on branching ratios are given. 11 refs., 11 figs., 5 tabs.

6596 (CERN-EP—88-104) Results on {lambda}{sub c}{sup +}, D{sub s}{sup +}, D{sup 0} and D{sup +} production properties in 230 GeV {pi}{sup {minus}}Cu interactions from the NA32 experiment. Barlag, S.; Becker, H.; Boehringer, T.; Bosman, M.; Castillo, V.; Chabaud, V.; Damerell, C.; Daum, C.; Dietl, H.; Gillman, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Aug 1988. 36p. (CONF-880867—12). NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89003202/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

Results on the {Lambda}{sub c}{sup +} baryon and D{sub s}{sup +}, D{sup 0}, D{sup +} mesons and charge conjugates produced in 230 GeV {pi}{sup minus}Cu interactions are presented. A dedicated trigger for selection of {Lambda}{sub c}{sup +} {yields} pK{sup {minus}}{pi}{sup +}, D{sub s}{sup +} {yields} K{sup +}K{sup {minus}}{pi}{sup +} (particle symbols stand for particles and antiparticles) was used. A high resolution vertex detector consisting of charge coupled devices and silicon microstrip detectors allowed the selection of very clean samples of {Lambda}{sub c}{sup +} and D{sub s}{sup +}. We obtained as well a large sample of D{sup 0} and D{sup +}. In a preliminary analysis, about 135 {Lambda}{sub c}{sup +} {yields} pK{sup {minus}}{pi}{sup +}, 66 D{sub s}{sup +} {yields} K{sup +}K{sup {minus}}{pi}{sup +}, 594 D{sup 0} {yields} K{sup {minus}}{pi}{sup +}, K{sup {minus}}{pi}{sup +}{pi}{sup {minus}}{pi}{sup +} and 256 D{sup +} {yields} K{sup {minus}}{pi}{sup +}{pi}{sup +} decays are fully reconstructed. Preliminary results on differential and total cross-section are given. In about 40 events, both decay vertices have been fully reconstructed. 12 refs., 15 figs., 4 tabs.

6597 (CERN-EP—88-106) Observation of the charmed strange baryon decay {Xi}{sub c}{sup +} {yields} {Xi}{sup {minus}}{pi}{sup +}{pi}{sup +}. Barlag, S.; Becker, H.; Boehringer, T.; Bosman. M.; Castillo, V.; Chabaud, V.; Damerell, C.; Daum, C.; Dietl, H.; Gillman, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Aug 1988. 7p. (CONF-880867—11). NTIS (US Sales Only), PC A02 - OSTI. Order Number DE89003201/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

We have observed 2 charmed strange baryon decays {Xi}{sub c}{sup +} {yields} {Xi}{sup {minus}}{pi}{sup +}{pi}{sup +}, {Xi}{sup {minus}} {yields} {Lambda}{sup 0}{pi}{sup {minus}}, {Lambda}{sup 0} {yields} p{pi}{sup {minus}} (and charge conjugate) in the data collected in 1985 and 1986 by the NA32 experiment using charge-coupled devices for vertex reconstruction and a trigger on a pair of opposite charge kaons and/or (anti) protons. The still preliminary analysis gives for the {Xi}{sub c}{sup +} mass a value around 2465 MeV. 5 refs., 3 figs.

6598 (CERN-EP—88-129) Neutral weak current phenomena. Winter, K. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Sep 1988. 21p. (CONF-8806204—7). NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89003185/JAW.

From 13. international conference on neutrino physics and astrophysics; Boston, MA, USA (5 Jun 1988).

Progress in experimental measurements of neutral current phenomena is reviewed. It is directly demonstrated that the neutral weak neutrino current is of V,' A structure (parity-violating) and that it couples both to left-handed and right-handed quarks. New data sensitive to the weak isospin structure of quarks are reported. The universality of nucleon structure as probed by the CC, NC and electromagnetic current is confirmed at the 5%--20% level. Progress in precise measurements of sin{sup 2}{Theta}{sub w} gives new limits on M{sub Z'}, m{sub t}, on lepton compositeness and on electromagnetic properties of neutrinos. 32 refs., 6 figs., 6 tabs.

6599 (DOE/ER/40313—1) [Data acquisition and analysis for the MEGA experiment]: Technical progress report. (Yale Univ., New Haven, CT (USA). Wright Nuclear Structure Lab.). 1988. Contract FG02-87ER40313. 3p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003541/JAW.

This paper briefly describes rare muon decay physics at LAMPF. Data acquisition hardware and software, proton arm wire chambers, and replay software systems are discussed.

6600 (GSI—88-32(prepr.)) New limits for resonant Bhabha scattering around the invariant mass of 1.8 MeV/c/sup 2/. Tsertos, H.; Kozhuharov, C.; Armbruster, P.; Kienle, P.; Krusche, B.; Schreckenbach, K. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Institut Laue-Langevin, 38 - Grenoble (France)). Jun 1988. 6p. Also published in Z. Phys., A: At. Nuclei (Sep 1988) v. 331(1) p. 103-104.

The excitation function for Bhabha scattering was reinvestigated in the energy range between 775 and 840 keV (c.m.) in 1.4 keV steps using a monoenergetic e/sup +/-beam and a high-resolution kinematic coincidence detector device. Corroborating our previous results, no resonance was observed around 1.8 MeV/c/sup 2/ up to an improved upper limit of 0.5 b.eV/sr (c.m.) for the energy-integrated differential cross section (97% C.L.). The data rule out the existence of a resonance with a cross section of 5.0 b.eV/sr, recently reported elsewhere.

6601 (IFVE-OEF/OEIUNK—87-155) Study on the light meson radiative decays. Bityukov, S.I.; Borisov, G.V.; Viktorov, V.A. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704494/JAW.

Submitted to the journal Sov. J. Nucl. Phys.

The search for near radiative decays for some light mesons has been performed at the installation "Lepton-F". Charge exchange reactions of π/sup -/ and K/sup -/ mesons at the momentum 32.5 GeV/c were used as a source of these mesons. The decay of axial meson D(1285)->phiγ has been observed and the branching ratio Br(D(1285)->phiγ)=(0.9+-0.2+-0.4)x10/sup -3/ has been determined. Upper limits for radiative decays probabilities ω->π/sup +/π/sup -/γ and f(1525)->phiγ have been obtained. 26 refs.; 9 figs.

6602 **(IFVE-ONF-OEIUNK—87-189) Charmed D meson production in the pp interactions at 400 GeV/c.** Aguilar-Benitez, M.; Allison, V.V.; Bailey, J. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 11p. (In Russian). (CERN-NA—27). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704498/JAW.

Submitted to the journal Sov. J. Nucl. Phys.

The inclusive production properties of D- and D-bar-mesons, produced from pp-interactions at $\sqrt{s}$=27.4 GeV are measured. Inclusive D/D-bar cross section is equal to 30.2+-3.3μb. The QCD fusion model predicts D/D-bar production which is in good agreement with obtained data, except for the magnitude of the cross section, which depends sensitively on the assumed mass of the charm quark. 11 refs.; 2 figs.; 1 tab.

6603 **(IFVE-ONF-OEIUNK—88-30) Characteristics of the Λsub c/ production in pp interactions at 400 GeV/c.** Aguilar-Benitez, M.; Allison, V.V; Bailey, J. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704499/JAW.

Submitted to the journal Sov. J. Nucl. Phys.

Results of the measurements of Λsub c/ production cross sections in proton proton interactions at $\sqrt{s}$=27.4 GeV are presented. New limits on the relative decay probability Λsub c/->pK/sup -/π/sup +/ are shown. 7 refs.; 2 figs.; 2 tabs.

6604 **(INFN/BE—88-3) Simulation of inelastic hadron collisions below 5 GeV. A modification of GEANT3 package.** Pedroni, P. (Istituto Nazionale di Fisica Nucleare, Pavia (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704514/JAW.

To evaluate the detector characteristics in an experiment designed to study photoproduction and photodisintegration at energies above pion production threshold at the Saclay linear accelerator (ALS), a Monte Carlo simulation program has been written. The CEREN FORTRAN package GEANT3 which has been modified to correctly generate hadronic interactions of particle with momenta below a few GeV has been used. In this note is described a simulation program in which GEANT3 has been corrected with the addition of a new hadronic library. Some comparisons between simulated and experimental data for detector has been provided.

6605 (INIS-SU—62/A, pp 86-88) **Polarization asymmetry in the inclusive reaction π/sup -/parrow up->π/sup 0/X n region of 0.2<x≦ and p/sub T/ ≦eV/c at 40 GeV/c.** Apokin, V.D.; Arestov, Yu.I.; Belikov, N.I. and others. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The first results on the measurement of "raw" asymmetry in the reaction π/sup -/+p -> π/sup 0/+X in the region of 0.2<x < 1 and 0<p/sub T/≦ GeV/c at the incident π/sup -/-meson momentum of 40 GeV/c are presented. The mean value of the asymmetry for the region 0.2<x≦.6 (p/sub T/<1GeV/c) is (-1.3+-0.3)% while for the region of 0.6<x≦ (p/sub T/ is the same) equals (0.8 +- 0.5)%. 9 refs.; 2 figs.

6606 (INIS-SU—68, pp 231) **Investigation of the antineutrino-deuteron interaction at Rovno reactor.** Mikaehlyan, L.A.; Nikolaev, S.V.; Skorokhvatov, M.D.; Smirnov, A.V.; Fayans, S.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6607 **(INS—694) Neutrino oscillations as a possible solution to the anomalous atmospheric neutrino flux.** Hidaka, K.; Honda, M.; Midorikawa, S. (Tokyo Gakugei Univ., Koganei (Japan). Dept. of Physics). (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1988. 14p. (ICR—171-88-17). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755496/JAW.

We investigate the atmospheric ν/sub e/ and ν/sub μ/ fluxes recently observed at Kamiokande and find that they deviate significantly from the expected values even if we take into account the effect of the polarization of the muons which are produced mainly by π -> $\mu\nu$ decay. We find that it is possible to explain the data by three-neutrino oscillations. The two neutrino oscillations ν/sub e/ reversible ν/sub μ/ are not favored. Models of three neutrino flavors with neutrino mass squared differences of order 10/sup -2/ eV/sup 2/ can solve both the solar and the atmospheric neutrino problems simultaneously.

6608 **(ITEF—89(1987)) Search for narrow dibaryons with mass near 2 GeV. (proposal of experiment).** Kondratyuk, L.A.; Radkevich, I.A.; Sutormin, A.I.; Chuvilo, I.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704964/JAW.

Dibaryon resonances (B/sup 2/) are supposed to be searched for, measuring effective mass (EM) of the pp-system in the p+d -> ppπ/sup +-/ p/sub s/ reaction at momentum 2 GeV/c using the 3-m spectrometer. Accuracy of EM measurement is 3-4 MeV with mass M/sub pp/=2 GeV. A set of 5-7 thousands of events in a resonance at total number of triggers equalling 200 thousands per 100 hours of accelerated time if possible at proton beam intensity 10/sup 5/s/sup -1/, a dueterium target of 20 cm long, dead time of equipment 200 ms, adn accelerator utilization factor 0.5. Such statistics permits to determine the problem on existence of narrow B/sup 2/ with mass ~ 2 GeV and in their presence gives the possibility to determine their quantum number. 13 refs.; 2 figs.

6609 **(KEK—87-26) Proceedings of the first workshop on the neutron lifetime.** (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jan 1988. Vp. (CONF-8711247—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780028/JAW.

From 1. workshop on the neutron lifetime; Oho, Japan (19 Nov 1987).

Separate abstracts were prepared for the papers presented at this meeting.

6610 **New limits on K/sub L//sub ,//sub S/→$\pi^0e^+e^-$.** Gibbons, L.K.; Papadimitriou, V.; Patterson, J.R.; Wah, Y.W.; Winstein, B.; Winston, R.; Woods, M.; Yamamoto, H.; Swallow, E.C.; Bock, G.J.; and others. (The Enrico Fermi Institute and the Department of Physics, The University of Chicago, Chicago, Illinois 60637). *Physical Review Letters;* **61**: No. 23, 2661-2664(5 Dec 1988).

Data taken in a Fermilab experiment designed to measure to CP-violation parameter $\epsilon/\epsilon$from a study of K→2π decays were used to look for the as yet unseen decay modes K/sub L//sub ,// sub S/→$\pi^0e^+e^-$. The detector was optimized for the detection of kaon decays with four electromagnetic showers in the final state. The results (90% confidence) are branching ratios <4.2 x 10/sup -8/ and <4.5 x 10/sup -5/ for K/sub L/→$\pi^0e^+e^-$ and K/sub S/ →$\pi^0e^+e^-$, respectively.

6611 **Statistical study of tau-decay data.** Hayes, K.G.; Perl, M.L. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309). *Physical Review [Section] D: Particles and Fields;* **38**: No. 11, 3351-3364(1 Dec 1988).

In the measured decay properties of the tau there is a discrepancy between the total branching fraction for the one-charged-particle decay modes and the sum of the branching fractions for the known individual modes. This discrepancy is derived from about 60 different measurements of branching fractions and some use of

weak-interaction theory. Our statistical study of these 60 measurements shows there are problems in some of the measurements in the estimation of experimental bias or systematic error. But there is no evidence that the discrepancy derives from experimental bias or from incorrect estimation of systematic error.

6612 **Search for neutral metastable penetrating particles produced in the SLAC beam dump.** Bjorken, J.D.; Ecklund, S.; Nelson, W.R.; Abashian, A.; Church, C.; Lu, B.; Mo, L.W.; Nunamaker, T.A.; Rassmann, P. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **38**: No. 11, 3375-3386(1 Dec 1988).

A search was made for neutral objects which might be produced by 20-GeV electrons incident on the SLAC beam dump, penetrate the downstream natural shielding, and decay upstream of an electromagnetic shower calorimeter. With about 30 C of electrons dumped, no candidate events were found above an energy of {similar←to} GeV. The 95%-confidence-level limit on the product of mass and lifetime of light axionlike bosons decaying primarily into two photons is determined to be greater than 1.4 keV sec. Limits on photino parameters are also given.

6613 **πp p charge-exchange analyzing power from 547 to 687 MeV/c.** Wightman, J.A.; Eichon, A.D.; Kim, G.J.; Mokhtari, A.; Nefkens, B.M.K.; Briscoe, W.J.; Fitzgerald, D.H.; Sadler, M.E. (Department of Physics, University of California, Los Angeles, California 90024). *Physical Review [Section] D: Particles and Fields;* **38**: No. 11, 3365-3374(1 Dec 1988).

The π^-p charge-exchange analyzing power has been measured from 547 to 687 MeV/c in the center-of-mass angular range -0.9≦ostheta-tilde/sub π/≦.9 using a transversely polarized target. The recoil neutron was detected in coincidence with a photon from π^0 decay. The results are compared with the three recent partial-wave analyses (PWA's); the VPI analysis is most consistent with our measured distributions except at 687 MeV/c where no PWA agrees with our data. The charge-exchange transversity cross sections are evaluated using the differential cross sections of Borcherding et al. These transversity cross sections are used in conjunction with earlier π/sup +- /p data by our group to test the triangle inequalities which are a model-independent test of isospin invariance. Our data satisfy these inequalities everywhere; in contrast, Abaev et al. have reported a violation of more than 5 standard deviations at 685 MeV/c.

6614 **Measurement of πid→Δsup ++/n at intermediate energy.** Pancella, P.V.; Mutchler, G.S.; Baker, S.D.; Kruk, J.W.; Duck, I.M.; Corcoran, M.D.; Phillips, G.C.; Clement, J.M.; Buchanan, J.A.; Mayes, B.W.; and others. (T. W. Bonner Nuclear Laboratories, Physics Department, Rice University, Houston, Texas 77251). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 6, 2716-2727(Dec 1988).

The threefold differential cross sections for the reaction π^+d→Δsup ++/n→π^+pn were measured in a kinematically complete experiment as a function of beam momentum and the Δ1232) production angle. The cross sections were measured at seven beam momenta between 312 and 600 MeV/c for θsub Δ = 55° and 91° in the center-of-mass system. Angular distributions from 30° to 119° (c.m.) were taken at beam momenta of 350 and 425 MeV/c. These data are compared with predictions from a unitary, relativistic, three-body theory based on the Faddeev equations and with a multiple scattering theory. The theories reproduce the general trend of the data except at the highest energies.

6615 **Intersections between particle and nuclear physics.** Bunce, G.M. (ed.). New York, NY; American Institute of Physics (1988). 1263p. American Institute of Physics, 335 East 45th Street, New York, NY 10017. Order Number TI89002505/JAW. Contract AC02-76CH00016.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

This report contains papers from an AIP conference on the intersections between particle and nuclear physics. Some of the general topics covered are: Accelerator physics; Antiproton physics; Electron and muon physics; Hadron scattering; Hadron spectroscopy; Meson and lepton decays; Neutrino physics; Nonaccelerator and astrophysics; Relativistic heavy-ion physics; and Spin physics. There are 166 papers that will be processed separately. (LSP)

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 6954

6616 **(DOE/ER/40211—4) Research in theoretical physics: Annual progress report for period April 1, 1988--March 31, 1989.** Domokos, G.; Kovesi-Domokos, S. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics and Astronomy). Nov 1988. Contract FG02-85ER40211. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003455/JAW.

This report contains a summary of research carried out in order to search for a substructure of quarks and leptons. Theoretical predictions valid for a large class of composite models suggest enhanced muon production in high energy lepton-induced reactions. A tentative analysis of some cosmic ray data indicates that the predictions of such models are in accordance with the data. In order to move towards the construction of satisfactory composite models, a study of gauge invariant effective actions and phase transitions in gauge theories was begun. 20 refs., 1 fig.

6617 **(IAE—4636/2) Weak ωNN coupling in the nonlinear chiral model.** Shmatikov, M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 12p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704954/JAW.

In the non-linear chiral model with the soliton solution stabilized by the ω-meson field the weak ωNN coupling constants are calculated. Applying the vector dominance model for the isoscalar current the constant of the isoscalar P-odd ωNN interaction h/sub ω//sup (0)/=0 is obtained while the constant of the isovector (of the Lagrangian of the ωNN interaction proves to be h/sub ω//sup (1)/ ≅ 1.0x10/sup -7/. 7 refs.

6618 **(INFN/AE—88-2) Physico mathematical approach to generalized monopoles without a string.** Rodrigues, W.A.; Faria Rosa, M.A.; Maia, A. (Trento Univ. (Italy). Dip. di Metematica; Universidade Estadual de Campinas (Brazil). Inst. de Matematica, Estatistica e Ciencia da Computacao). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1988. 47p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704513/JAW.

A theory of the generalized magnetic monopole without string, which is distinct from Dirac's original theory and also distinct from the topological theory of the monopole is presented. This theory is first formulated in the Clifford bundle formalism; and in the particular case of electrodynamics it is deduced from Maxwell equations the generalized Lorentz force and the equations of motion of charges and monopoles. The conservation laws and the problem of Lagrangian formalism are discussed. Dirac quantization condition in two different ways are obtained. Finally a principal fiber formulation of the theory using the spliced bundle concept with gauge group GxG, where G is the gauge group of the theory without monopoles, is presented. 21 refs.

6619 (INIS-SU—43, pp 30-32) **Confinement effects and e/sup +/e/sup -/ -> π/sup +/π/sup -/γ reaction.** Dremin, I.M.; Nazirov, M.T. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

In a model, where confinement is taken into account by restricting the spatial region of existence of quarks and gluons as free particles, the e/sup +/e/sup -/ -> π/sup +/π/sup -/γ reaction is considered. It is shown that the confinement effect on photon emission results in the observed effect. 6 refs.; 3 figs.

6620 (INIS-SU—62/A, pp 11-19) **Polarization as a probe of dynamics in particle reactions.** Moravchik, M.J.; Goldshtejn, G.R. (Oregon Univ., Eugene (USA). Inst. of Theoretical Physics; Tufts Univ., Medford, MA (USA). Dept. of Physics). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The polarization analysis of inclusive reactions, which play a major role in very high energy particle physics and for which a new major facility is being built at Fermilab fulfilled. High energy pion-nucleon reactions to test various QCD-based models are also considered. The proton-proton elastic scattering at relatively law energies is reported. The above applications of polarization studies illustrate the wide variety of instances in which polarization represents an indespensible means to explore reaction dynamics. It is evident that measuring only unpolarized cross sections would get nowhere in any of the problems. Polarization studies form the cutting adge of elementary particle studies. 12 refs.

6621 (INIS-SU—62/A, pp 32-33) **Spin in exclusive processes in the string /sup 3/P/sub 0/ model.** Levintov, I.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Charge exchange exclusive interaction π/sup -/p -> π/sup 0/n is considered. The reaction involving spins is described. An annihilation of a pair qq-bar at formation of a string occurs with the vacuum quantum numbers 3p/sub 0/ is taken into account. The ratio of charge exchange reaction amplitudes M/sub 1//M/sub 0/ is determined by geometrical structure spherical function. 1 ref.

6622 (INIS-SU—62/A, pp 26-27) **Spin effects in πN and NN-scattering processes at high energies and fixed angles.** Chavleishvili, M.P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Processes πN- and NN-scattering at high energies and large fixed angles are analysed in detail. Based on the suggestion about weakening spin correlations in interactions, series of inequalities for helicity amplitudes ("kinematical hierarchi") are found. In observable quantities some of contributions of amplitudes are kinematically increased and others are suppressed. For elastic πN-scattering there is an asymptotical dominance of the helicity nonflip amplitude over the helicity flip amplitude and the results are in agreement with the results obtained in QCD. For NN-scattering there is not helicity conservation. 4 refs.

6623 (INIS-SU—62/A, pp 34-36) **Hadron polarization with zero quark polarization.** Arestov, Yu.I. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The polarization of quarks, forming a polarized hadron in production processes is discussed. The graph illustrating qq-scattering block and hadronization vertex p-> n, Σ/sup +-/, γ/sup 0/, is presented. The problem of obtaining a polarized neutron if produced d quark is not polarized is discussed. 1 ref.; 1 fig.

6624 (INIS-SU—62/A, pp 23-25) **Polarization in exclusive processes and dynamics of hadronic interactions.** Troshin, S.M.; Tyurin, N.E. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Spin effects at high energies are studied to investigate the dynamics of hadronic interactions. Quark model for U matrix is applied to the description of spin phenomena in hadronic interactions. A large value of the polarization in elastic hadron scattering at large angles indicates that the valence quark scattering mechanisms with and without helicity flip differ greatly. Valence quark scattering with no helicity flip may be treated as a collective effect which reflects interaction of valence quark with the whole cloud of the virtual qq-pairs, while the mechanism of quarks helicity flip implies the interaction with one quark from the cloud through quark or glueball exchange. A strong energy dependence of the spin correlation parameter A/sub nn/ and oscillations of dσdt(s,90 deg) may be considered as a manifestation of resonance effects at the quark level. The presence of a considerable polarization in inelastic binary reactions makes it clear that in such processes hadron helicity flip is due to inelastic quark transitions. 5 refs.; 1 fig.

6625 (INIS-SU—68, pp 247) **Elastic scattering of reactor antineutrinos on electron and limitation on mass of supplementary neutral boson.** Bogdanov, Yu.P.; Kerimov, B.K.; Safin, M.Ya. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6626 (INIS-SU—68, pp 261) **Photon radiation in ν-bar/sub e/e/sup -/ annihilation into hadrons.** Abdullaev, S.K.; Aliev, L.P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6627 (INIS-SU—68, pp 257) **Photoproduction of e/sup +/e/sup -/ pairs in partially disoriented crystal targets by circular polarized γ quanta.** Nadzhafov, I.M.; Radzhabov, M.R. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6628 (INIS-SU—68, pp 260) **Electroweak asymmetries in e/sup -/e/sup +/ -> fX annihilation in the framework of different gauge models.** Abdullaev, S.K.; Mukhtarov, A.I.; Aliev, L.P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6629 (INIS-SU—68, pp 134) **Skyrmeon and anomalies in nuclear physics.** Andrianov, V.A.; Novozhilov, V.Yu. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6630 (INIS-SU—68, pp 135) **Recovery of chiral symmetry in quantum chromodynamics and core origin in nucleon-nucleon potential.** Andrianov, V.A.; Novozhilov, V.Yu. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6631 (INIS-SU—68, pp 152) **Role of tensor forces in Λ interactions.** Krasnov, I.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6632 (INIS-SU—68, pp 154) **Resonance long-range interaction in NΔsystems.** Pokrovskij, Yu.E. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6633 (INIS-SU—68, pp 155) **Quasi-nuclear dibaryon resonances.** Pokrovskij, Yu.E. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6634 (INIS-SU—68, pp 156) **Nucleon-nucleon scattering in 0-3 GeV range and quark degrees of freedom in nuclei.** Dorodnykh, Yu.L.; Neudachin, V.G.; Yudin, N.P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6635 (INIS-SU—68, pp 157) **Realistic nucleon-nucleon forces and calculation results of NN interaction in quark cluster model.** Obukhovskij, I.T.; Kusainov, A.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6636 (INIS-SU—68, pp 259) **Study on cross section of massive lepton pair production and hadron structure functions in pion - nucleus collision.** Sadykhov, F.S. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6637 (INIS-SU—68, pp 458) **High-energy behaviour of scattering amplitude.** Gadzhiev, S.A.; Dzhafarov, R.K. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6638 **(INS—693) Pions in nuclei, from virtual-pion exchange to real-pion transfer.** Yamazaki, Toshimitsu. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755495/JAW.

Tracing the work of Miyazawa on nuclear magnetic moments, we discuss possible experimental ways to see whether a real pion exists in nuclei or not. While virtual pions are known to play an important role in nuclei, as clarified experimentally from anomalous orbital g factors of nucleons in nuclei, nearly nothing is known for the behavior of real pions in nuclei. We have shown that deeply bound hybrid states of π/sup -/ are expected to exist in heavy nuclei, which can be populated by "pion transfer" reactions.

6639 (INS-J—173, pp 1-32) **Contemplation on composite and string models.** Terazawa, Hidezumi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

Relations between composite models and string models are clarified. The subjects to discuss include 1) philosophy, 2) space-time, 3) matter, 4) symmetry, 5) dynamics, 6) principle, 7) predictions, 8) tests and 9) current and future problems.

6640 (INS-J—173, pp 33-51) **Excited weak gauge bosons at pp-bar colliders.** Yasue, Masaki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

Composite vector bosons are introduced as matter fields (to be called 'excited weak gauge bosons', W* and Z*) in an effective theory with a local symmetry SU(2)/sub L//sup loc/ x U(1)/sub Y//sup loc/. After constraints from the well-established low-energy phenomenology are properly taken into account, we estimate production cross sections for W* and Z* and expected numbers of events arising from the W*- and Z*-decays.

6641 (INS-J—173, pp 53-69) **B meson physics and related new physics.** Tanimoto, Morimitsu. (Ehime Univ., Matsuyama (Japan). Science Education Lab.). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We have surveyed the some models focusing on the mixings, the CP violation and the rare decay in the B meson system. The ARGUS data of the B/sub d//sup 0/-B-bar/sub d//sup 0/ mixing gives us some constraints as to parameters of these models. Especially, we have investigated the composite scale in detail using the ARGUS data of the B/sub d//sup 0/-B-bar/sub d//sup 0/ mixing and obtained some interesting results.

6642 (INS-J—173, pp 83-92) **Vertex construction and zero modes of twisted strings on orbifolds.** Kunitomo, Hiroshi. (Kyoto Univ. (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

The quantization of zero modes is clarified for twisted strings on orbifolds. The additional constrained zero modes are introduced to treat the transitions of the center-of-mass coordinate. By using these, the untwisted state emission vertex operators are written in the simple form. The vertex operator is naturally equipped with cocycle factors and describes the correct jumps of the center-of-mass coordinate due to the emission of the winding string.

6643 (INS-J—173, pp 93-111) **Classification of symmetry breaking by Wilson lines on the Z orbifold.** Sato, Hikaru. (Hyogo Univ. of Education (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We give complete classification of gauge symmetry breaking by Wilson lines on the standard Z orbifold by deriving the general formula of the conditions of modular invariance and group invariance in the presence of background gauge fields. All possible E/sub 6/ x SU(3) breaking in terms of one Wilson line is given. The symmetries of the electroweak and grand unification are obtained by combining two Wilson lines.

6644 (INS-J—173, pp 187-190) **Comments on the equivalence between the Mandelstam and Polyakov pictures for fermionic string.** Hamada, Ken-ji; Takao, Masaru. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We investigate the light-cone gauge formulation of fermionic string of Mandelstam in a superspace at the one-loop level. The extension to the higher-loop case is also discussed. Using the theory of super Riemann surface, we calculate the one-loop amplitude with N-massless vector particles. We demonstrate that the resulting amplitude is written in the form of a correlation function of the vertex operators. This means that the amplitude in the Mandelstam approach is equivalent to the one in the Polyakov approach at the one-loop level.

6645 (INS-J—173, pp 191-198) **Modified superstring in light cone gauge.** Kamimura, Kiyoshi; Tatewaki, Machiko. (Toho Univ., Funabashi, Chiba (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We analyze the covariant superstring theory proposed by Siegel in light cone gauge. The physical states are the direct product of those of Green-Schwarz Superstring and the additional internal space spanned by light cone spinors. At clasical level, there is no difference among observables in Siegel's modified Superstring theory (SMST) and Green-Schwarz's one (GSST). However SMST can not be quantized with additional constraints as the physical state conditions.

6646 (INS-J—173, pp 213-225) **Generalized supersymmetry on Riemann surfaces and the associated string models.** Nakanishi, Tomoki. (Tokyo Univ. (Japan). Inst. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

It is shown that a generalization of the concept of supersymmetry on Riemann surfaces is possible. As a result, infinete numbers of candidates for consistent string models are obtained.

6647 **(INS-J—173) Proceedings of 7th INS winter seminar on superstring, composite models and enomaly related problem.** (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1988. Vp. (CONF-8712125—). NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW.

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

Separate abstracts were prepared for the papers presented a this meeting.

6648 (JINR—D-2-87-123, pp 81-88) **Loop avarages formalism and renormalization group for infrared asymptotics in QCD.** Korchemskij, G.P.; Radyushkin, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

It is established that IR asymptotics of an arbitrary QCD process is described by loop averages. On the basis of analysis of renormalization properties of the loop averages and their structure the RG equation for IR asymptotics on the mass surface is obtained. A new specific object - anomalous dimensions of R-ordered exponents - has appeared in this equation. A two-loop contribution into the angular anomalous dimension is calculated and some of its properties in higher orders of perturbation theory relating to the possible functional form are found. 12 refs.

6649 **(JINR—E-2-87-432) Electromagnetic structure of pion in the framework of adjusted VMD model with elastic cut.** Dubnicka, S.; Furdik, I.; Meshcheryakov, V.A. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704602/JAW.

The vector dominance model (VMD) parametrization of pion form factor is transformed into the pion c.m. momentum variable. Then the corresponding VMD poles are shifted by means of the nonzero widths of vector mesons from the real axis into the complex region of the second sheet of Riemann surface generated by the square-root two-pion-threshold branchpoint. A realistic description of all existing data is achieved in the framework of this adjusted VMD model and the presence of rho'(1250) and rho''(1600) mesons in e/sup +/e/sup -/->π/sup +/π/sup -/ is confirmed by determination of their parameters directly from the fit of data. 25 refs.

6650 **Weak-isospin violation in "walking" technicolor.** Chivukula, R.S. (Physics Department, Boston University, Boston, Massachusetts 02215). *Physical Review Letters;* **61**: No. 23, 2657-2660(5 Dec 1988).

We show that the mechanism which enhances ordinary fermion masses and raises the masses of pseudo Goldstone bosons in walking-technicolor models may also lead to an enhancement of weak-isospin--violating effects of extended-technicolor interactions. We discuss the constraints on these models due to limits on the deviation of the rho parameter from 1.

6651 **Deuteron as a toroidal Skyrmion.** Braaten, E.; Carson, L. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60201). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3525-3539(1 Dec 1988).

The minimal-energy baryon-number-two solution of the Skyrme model is a static soliton which is approximately toroidal in shape. The symmetries of this solution imply that the ground state and the first excited state of this soliton have the quantum numbers of the deuteron d and its unbound isovector $^1S_0$ state. These identifications are tested by calculating the static electromagnetic properties of the deuteron and the transition moment for photodisintegration of the deuteron via the excitation, $\gamma d \rightarrow {}^1S_0$. The results are consistent with the interpretation of the deuteron as a quantum state of a toroidal Skyrmion.

6652 **Nonstandard neutral weak boson and elastic electron-proton scattering.** Hwang, W.P. (Department of Physics, National Taiwan University, Taipei, Taiwan 10764, China). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3427-3436(1 Dec 1988).

The prospect of using a precision measurement of parity violation in elastic electron-proton scattering in the GeV range to detect manifestations of the nonstandard neutral weak boson Z'^0 is investigated in some detail. The numerical results indicate that, for an assumed Z'^0 mass of about 300 GeV, the deviation of the predicted parity-violating beam and target asymmetries from those given by the standard Glashow-Weinberg-Salam electroweak theory can be in the vicinity of several percent. Thus, confirmation of the standard model to within an accuracy of a couple of percent in such measurement should yield a severe constraint on the possible existence of the nonstandard neutral weak boson.

6653 **Production mechanisms for nonminimal Higgs bosons at an e^+e^- collider.** Gunion, J.F.; Roszkowski, L.; Turski, A.; Haber, H.E.; Gamberini, G.; Kayser, B.; Novaes, S.F.; Olness, F.; Wudka, J. (Department of Physics, University of California, Davis, California 95616). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3444-3460(1 Dec 1988).

We discuss mechanisms for the production of the Higgs bosons of the minimal supersymmetric model at an e^+e^- collider. In particular, we focus on those Higgs bosons that are predicted to have zero or weak couplings to vector-boson pairs, and hence cannot be produced by the standard mechanisms.

6654 **Radiatively induced seesaw mechanism for neutrino masses.** Babu, K.S.; Mathur, V.S. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3550-3553(1 Dec 1988).

It is shown that small and calculable Majorana neutrino masses featuring the seesaw mechanism can be induced radiatively in the context of left-right-symmetric models. An exactly conserved multiplicative quantum number and the possibility of low-mass right-handed gauge bosons (m/sub W//sub >//sub R//sub =/ {similar←to}00 GeV) are additional features of the model presented.

6655 **Particle productivity in pp and pA collisions.** Chen, W.R.; Hwa, R.C.; Wang, X. (Institute of Theoretical Science and Department of Physics, University of Oregon, Eugene, Oregon 97403-5203). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3394-3396(1 Dec 1988).

In the framework of the geometrical branching model for pp and pA collisions, we discuss the dependence of the particle-productivity function on impact parameter and give a new description for it without any free parameter. It is then shown that an excellent description of the pp data is obtained.

6656 **Composite leptoquarks in hadronic colliders.** Eboli, O.J.P.; Olinto, A.V. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3461-3466(1 Dec 1988).

We study the production of composite scalar leptoquarks in hadronic colliders (CERN p-barp, Fermilab Tevatron p-barp, and the Superconducting Super Collider pp). We examine its direct single production via qg→l+leptoquark, and its effect on the production of lepton pairs (p/sup (-)/p→l^+l^-).

6657 **Signatures for fourth-generation quarks and a heavy top quark at the Superconducting Super Collider.** Baer, H.; Barger, V.; Goldberg, H.; Ohnemus, J. (Physics Department, Florida State University, Tallahassee, Florida 32306). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3467-3474(1 Dec 1988).

We examine methods for detection of new heavy quarks at the Superconducting Super Collider where the heavy quark could be either one of a fourth generation of quarks (a,v), or a very massive ({similar←to}50 GeV) top quark. The signals can be classified according to number of leptons in the final state. Requiring the presence of a single fast isolated lepton along with ≧ jets and pX/ sub T/ allows one to separate the a,v, or t signal from backgrounds. Heavy-quark pairs are produced with sufficient hemispheric separation to allow the direction of one of the quarks to be tagged by the transverse momentum of the isolated high-p/sub T/ lepton. A distinct enhancement is then observed at the heavy-quark mass in the cluster mass spectrum of all jets moving opposite to the lepton. A fourth-generation quark should also be visible in the two isolated lepton channel, and its mass resolvable. Additional signals from multilepton events would then also be present, though these channels may not yield a heavy-quark mass determination.

6658 **Transverse-momentum distribution of Higgs bosons at the Superconducting Super Collider.** Hinchliffe, I.; Novaes, S.F. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3475-3480(1 Dec 1988).

We consider the transverse-momentum distribution of Higgs-boson production in gluon-gluon fusion. Using resummation techniques we obtain a result valid at all transverse momenta. The resulting distributions are compared with those from the WW fusion mechanism and with those produced by event generators.

6659 **Can the Higgs bosons of the minimal supersymmetric model be detected at a hadron collider via two-photon decays?.** Gunion, J.F.; Gamberini, G.; Novaes, S.F. (Department of Physics, The University of California, Davis, California 95616). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3481-3487(1 Dec 1988).

Detection at a hadron collider of the neutral Higgs bosons of the minimal supersymmetric extension of the standard model is not straightforward. Their decays to WW and ZZ pairs are either phase-space forbidden or are suppressed or absent at the coupling-constant level; thus, detection of these neutral Higgs bosons in such modes will not be possible. Their detection in heavy-quark decay modes is also almost certainly impossible due to large QCD backgrounds. One possible detection mode (that proves useful for a standard-model Higgs boson with mass below 2m/sub W/ and 2m/ sub top/) is via decays to two photons. We investigate the branching ratio for such decays as a function of Higgs-boson mass for a selection of neutralino and chargino mass-matrix parameters. Except for a few limited regions of parameter space, we conclude that this mode of detection is probably not viable given the known two-photon continuum backgrounds.

6660 **Crossing constraints for hyperon reactions.** Ji, C.; Cotanch, S.R. (Department of Physics, North Carolina State University, Raleigh, North Carolina 27695). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2691-2699(Dec 1988).

The importance and usefulness of crossing is emphasized for both kaon scattering and kaon production reactions. It is argued, and numerically demonstrated for a chiral Lagrangian, that crossing provides powerful, comprehensive constraints which are often neglected in the evaluation of dynamical models. Cross section calculations are presented for two distinct sets of crossing related reactions: (1) $K^-p\rightarrow K^-p$, $K^+p\rightarrow K^+p$ and p-barp→K^-K^+; (2) $K^-p\rightarrow\gamma\Lambda$and $\gamma p\rightarrow K^+\Lambda$ The crossing relations require that the same hadronic Lagrangian, including coupling constants, govern all of these reactions, and results show that different reactions exhibit different sensitivity to coupling constant uncertainty. Because crossed reactions always entail different kinematic regions of the S matrix, it is expected that such sensitivity is not just representative of the current model but rather a general feature that should be exploited when investigating all relativistic theories.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 6348, 6652, 6654, 6687, 7002

6661 **(INS—692) Time translational symmetry.** Lehto, M.; Nielsen, H.B.; Ninomiya, Masao. (Jyvaeskylae Univ. (Finland). Dept. of Physics). (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755494/ JAW.

An attempt is made to understand time translational invariance as a purely formal symmetry. The idea is that even if time translational invariance is broken in the basic quantum mechanical Hamiltonian, one can anyway rewrite the physical model in a time translational invariant manner. One may argue that it is this kind of a formal invariance that is seen experimentally.

6662 **(INS—695) Wilson-loop symmetry breaking reexamined.** Nakamura, A.; Shiraishi, K. (Tokyo Metropolitan Univ. (Japan). Dept. of Physics). (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jul 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755497/JAW.

The splitting in the energy of gauge field vacua on non-simply connected space S/sup 3//Z/sub 2/ is reconsidered. We show the calculation to the one-loop level for a Yang-Mills vector with a ghost field. We confirm our previous result and give a solution to the question offered by Freire, Romao and Barroso.

6663 (INS-J—173, pp 71-81) **Transversally extended string.** Akama, Keiichi. (Saitama Medical Coll., Moroyama (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

Starting with the space-time action of the transversally extended string, we derive its world-sheet action, which is that of a gravitational and gauge theory with matter fields on the world-sheet, with additional effects of the second fundamental quantity.

6664 (INS-J—173, pp 135-157) **String model with the extrinsic curvature term.** Itoi, C.; Kubota, Hiroshi. (Tokyo Inst. of Tech. (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

The string model with the extrinsic curvature is studied which is a gauge invariant field theory with higher order derivatives. We present an equivalent action without any higher order derivatives which keeps the gauge invariance. We point out the difficulty caused by the second class constraints in Dirac's canonical

method. Following a new method for dynamical systems with second class constraints, we construct a equivalent model which has no second class constraints but has a new gauge invariance. This gauge invariance guarantees the equivalence between the original model and new one. We show that the model can be quantized in this formalism. In a simple model, we show the nilpotence of the BRST charge under certain conditions, and discuss the unitarity of the theory.

6665 (INS-J—173, pp 171-185) **Two point functions on supertorus and super modular invariance.** Nishimura, Kimihide. (Kyoto Univ. (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

Supermoduli dependence and super modular transformation properties of two-point functions on supertorus are analyzed. We give explicit expressions of correlation functions of a scalar and ghost superfields. The supermoduli is also interpreted in the context of 2-dimensional supergravity theory.

6666 (INS-J—173, pp 199-211) **Fermionic construction of N = 0, 1, 2 (super) conformal algebras.** Kobayashi, Kenichiro; Odake, Satoru. (Tokyo Univ. (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We derive conditions for fermionic construction of N = 0, 1 and 2 (super) conformal algebras, and obtain some solutions satisfying these conditions. In the N = 2 case these conditions can be simplified when supercurrents are written by complex fermions.

6454 Field Theory

REFER ALSO TO CITATION(S) 6658, 6659

6667 **(IFVE-OTF—88-46) Finite-mode Poincare-covariant systems.** Gordeziani, D.N.; Jorjadze, G.P.; Sarishvili, I.T. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704960/JAW.

Control of the structure and properties of piezoceramics has been exercised by introduction of additions of salt solutions into porous ceramic specimens as well as into synthesized ceramic powder. TsTBS-3 piezoceramics belonging to materials of mean ferroelectric rigidity was investigated. Introduction of Mg/sup 2+/ , Ca/sup 2+/, Sr/sup 2+/ bivalent cations is shown to provide more uniform structure than that of the initial TsTBS-3 piezoceramics. Investigations conducted both in vitro and under conditions of serial production made it possible to establish improvement and stabilization of TsTS ceramic structure and properties when introducing additions of salts aqueous solutions. 15 refs.; 1 fig.

6668 **(INFN/AE—87-6) Operator product algebras in 2D conformal theory with C<1 central charge.** Petkova, V.B. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1987. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704512/JAW.

A generalized integral representation involving two types of charges is explored to construct correlation functions on the plane for c = 1-6/m(m+1) < 1 discrete unitary Virasoro series. The various local operator product algebras emerging contain (half)-integer spin fields. The examples include also a generalization for arbitrary m of the z/sub 2/ - statistics of the Ising model order - disorder fields.

6669 (INIS-SU—68, pp 248) **Transition annihilation radiation.** Bolotov, V.N.; Apanasenko, A.L.; Kuznichenko, A.V.; Lebedev, V.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6670 (INS-J—173, pp 113-118) **Vacuum gauge field and free energy of superstrings.** Shiraishi, Kiyoshi. (Tokyo Metropolitan Univ. (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

Wilson loops on torus are introduced into the partition function of open strings as Polyakov's path integral at one-loop level. Mass spectra from compactification and expected symmetry breaking are illustrated by choosing the correct weight for the contributions from annulus and Moebius strip.

6671 (INS-J—173, pp 119-133) **String field theory in curved space.** Kikkawa, Keiji; Maeno, Masahiro; Sawada, Shiro. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

The purely cubic action in the string field theory is shown to provide a set of equations of motion for background fields which agree to those obtained by the vanishing condition of βfunctions in the non-linear sigma model. Using the sigma model as an auxiliary tool, a systematic method for solving the string field theory in curved space is proposed.

6672 (INS-J—173, pp 159-170) **Comments on curvatures.** Hosoda, M.; Yamakoshi, H.; Shimizu, T. (Tokyo Metropolitan Univ. (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

Curvatures of the specific model of Berry, strings and ghost systems are discussed on a same footing within a purely geometrical point of view.

6673 (INS-J—173, pp 227-249) **Phase holonomy, topological action and path integral.** Kuratsuji, Hiroshi. (Ritsumeikan Univ., Kyoto (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

A review is given of the problems on the topological phase accompanying the adiabatic cyclic change by using the path integral method.

6674 (INS-J—173, pp 251-254) **Fermion contents and a dual structure in the generalized chiral Schwinger model.** Miyake, Shogo; Shizuya, Ken-ichi. (Tohoku Univ., Sendai (Japan). Dept. of Engineering Science). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We solve the generalized chiral Schwinger model with a Wess-Zumino term in a covariant operator formalism. The model is essentially specified by two parameters (σa). The fermion operator is constructed from the asymptotic boson fields in bosonized versions of the model. The model yields a sensible quantum theory in some restricted domain of $\sigma$and a. The gauge field becomes massive. The fermion is confined. The model has a dual structure such that the model specified by (σa) is equivalent to the model specified by another set (σ = - σ a' = a + 2sin2σ. This duality, in particular, reveals the equivalence of the Schwinger model and the axial-Schwinger model.

6675 (INS-J—173, pp 273-296) **Path-integral approach to the commutator anomalies.** Nishikawa, Tadashi; Tsutsui, Izumi. (Tokyo Inst. of Tech. (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

The commutator anomalies are studied for both the consistent and covariant currents in the path-integral formalism using the BJL procedure. Relations between these two types of commutator anomalies are established non-perturbatively by using Bardeen-Zumino's current relation. It is shown that all these commutator anomalies can be completely expressed by the current anomaly and Bardeen-Zumino's current relation, provided that G/sub 0//sup a/ = -(D center dot E)/sup a/ commutes with itself for the covariant case.

6676 (INS-J—173, pp 297-304) **Anomaly-free formulation of chiral gauge theory and quantum holonomy.** Itoh, Toshiharu; Odaka, Kazuhiko. (Tsukuba Univ., Ibaraki (Japan). Inst. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We investigate the quantization of a fermion field coupled to external gauge fields. Defining the S-matrix carefully by means of the time-dependent Bogoliubov transformation, we show a possibility of an anomaly-free formulation of chiral gauge theories. In this formulation the gauge anomaly is canceled by the non-trivial quantum holonomy of the fermionic Fock vacuum.

6677 (INS-J—173, pp 305-319) **Chiral gauge theories on a lattice.** Funakubo, Koichi; Kashiwa, Taro. (Kyushu Univ., Fukuoka (Japan). Dept. of Physics). Jul 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780027/JAW. (CONF-8712125—).

From 7. INS winter seminar on superstring, composite models and anomaly related problem; Tokyo, Japan (21 Dec 1987).

We show that chiral gauge theories can be put on a lattice by exploiting the idea of adding extra degrees of freedom. We also examine the lattice chiral Schwinger model to find that the gauge interaction imposes a restriction on the values of a parameter peculiar to the lattice fermion. Further we briefly discuss the renormalizability of the four-dimensional theory.

6678 (JINR—D-2-87-123, pp 9-33) **Renormalization group in modern physics.** Shirkov, D.V. 1987. (In Russian). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

Renormalization groups used in different regions of theoretical physics are discussed. Functional formulation of continuous group transformations forms the basis. It is shown that such a viewpoint permits to develop the common opinion using the notion of functional self-similarity which generalizes ordinary self-similarity associated with the laws of power similarity. On this basis a simple derivation of quantum-field renorm group "free' of the phylosophy of ultraviolet divergences, "different" renorm groups are compared. 39 refs.; 6 figs.

6679 (JINR—D-2-87-123, pp 34-45) **Renormalization group in lattice gauge theories.** Makeenko, Yu.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

A review of applications of the renormalization group in lattice gauge theories (LGT) is given. It considered of asymptotic freedom permits to pass over in LGT to the continuous limit and calculate dimensional physical quantities. An advanced scaling parameter for SU(3)-LGT, which approximately takes into account nonperturbative effects of special type resulting in corrections to the double-loop approximation for the Gell-Mann Low function is discussed. It is compared with the results of numerical calculations by the Monte Carlo method. The method of the Monte Carlo renormalization group and results obtained using this method for SU(3)-LGT are discussed. 16 refs.; 4 figs.

6680 (JINR—D-2-87-123, pp 46-59) **Applications of the reduction method.** Zimmermann, W. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Inst. fuer Physik). 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

A renoramalizable model of quantum field theory involving several independent coupling parameters, λsub 0/, ..., λsub n/ and a normalization mass K is considered. If the model involves massive particles a formulation of the renormalization group should be used in which the βfunctions are independent of the masses. The aim of the reduction method is to reduce the model to a description in terms of a single coupling parameter. Although the reduction method does not work for the gauge couplings it leads to reasonable mass constraints if applied to the Yukawa and the Higgs couplings. The underlying idea is that - whatever the fundamental interaction if going to be - eventually there is only one coupling which determines all parameters of the standard model. However, one should be skeptical about numerical results in the standard model. For the standard model is only an effective theory, its βfunctions are only approximate and change on their lowest order coefficients may have large effects on the reduction solutions. 11 refs.

6681 (JINR—D-2-87-123, pp 60-80) **Multiloop calculations and renormalization group.** Chetyrkin, K.G. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

Modern methods of analytical calculation of renormalization group functions and applications of these methods to analysis of Euclidean asymptotics of Green functions in the high momentum range are reviewed in brief. Special attention is paid to application of the renormalization group approach for studying the structure of nonleading, proportional to masses, terms of the appropriate expansions. prospects of further development and actual problems waiting their solution are discussed. 53 refs.; 5 figs.

6682 (JINR—D-2-87-123, pp 89-108) **Non-renormalization theorems for chiral anomalies and their applications.** Piguet, O.; Sibold, K. (Geneva Univ. (Switzerland). Inst. de Physique Theorique; Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

There is a collection of known results on BRS-invariance and the supercurrent. Non-renoramalization theorem for chiral anomalies is reported. Two applications of the theorem are given: construction of the Adler-Bardeen current and criterion for vanishing βfunction. 13 refs.; 2 tabs.

6683 (JINR—D-2-87-123, pp 109-121) **Renormalization group invariance in the presence of an instanton.** Ross, D.A. (European Organization for Nuclear Research, Geneva (Switzerland)). 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

A pure Yang-Mills theory which admits an instanton is under discussion. n=1 supersymmetric (SU-2) Yang-Mills theory, both in the Wess-zumino gauge and in manifestly supersymmetric supergauge is considered. Two-loop vacuum graphs are calculated.

The way a renormalization group invariance works under conditions of fermionic zero mode elimination is shown. 11 refs.; 6 figs.

6684 (JINR—D-2-87-123, pp 133-142) **Quantum field renormalization group in the theory of turbulence and magnetohydrodynamics.** Vasil'ev, A.N. (Leningradskij Gosudarstvennyj Univ. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

It is shown that quantum field formulation and practice of the renormalization group (RG) form an effective apparatus for studying stochastic hydrodynamics and MHD. On this basis one can reproduce the results of the Kolmogorov-Obukhov phenomenological theory, specify the region of its application and study such phenomenon as a turbulent dinamo. It is also important that the apparatus of quantum field renormalization group permits to conduct concrete calculations in the turbulence theory and talk about it in terms of the conventional critical behaviour theory. 9 refs.

6685 **(NORDITA—88/32-P-Prepr.) Perturbative string theory in BRST invariant formalism.** Di Vecchia, P.; Hornfeck, K.; Frau, M.; Lerda, A.; Sciuto, S. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy); State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics; Naples Univ. (Italy). Dipt. di Scienze Fisiche; Istituto Nazionale di Fisica Nucleare, Naples (Italy)). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Istituto Nazionale di Fisica Nucleare, Turin (Italy); State Univ. of New York, Stony Brook (USA). Inst. for Theoretical Physics; Istituto Nazionale di Fisica Nucleare, Naples (Italy)). 1988. 31p. (CONF-8805234—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755698/JAW.

From International meeting on geometrical and algebraic aspects of nonlinear field theory; Amalfi, Italy (1 May 1988).

In this talk we present a constructive and very explicit way of calculating multiloop amplitudes in string theories. The main ingredients are the BRST invariant N String Vertex and the BRST invariant twisted propagator. This approach naturally leads to the Schottky parametrization of moduli space in terms of multipliers and fixed points of the g projective transformations which characterize a Riemann surface of genus g. The complete expression (including measure) of the multiloop corrections to the N String Vertex for the bosonic string is exhibited.

6686 **(RRK—88-11) Background field method for nonlinear sigma-model in stochastic quantization.** Nakazawa, Naohito; Ennyu, Daiji. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Mar 1988. 31p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755531/JAW.

We formulate the background field method for the nonlinear σmodel in stochastic quantization. We demonstrate a one-loop calculation for a two-dimensional non-linear σmodel on a general Riemannian manifold based on our formulation. The formulation is consistent with the known results in ordinary quantization. As a simple application, we also analyse the multiplicative renormalization of the O(N) nonlinear σmodel.

6687 **Chiral parameters in a Coulomb-gauge model of chiral-symmetry breaking.** Matheson, A. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3566-3569(1 Dec 1988).

Chiral-symmetry breaking and confinement are studied in a Coulomb-gauge model of QCD. The gap equation for the generated quark self-mass is solved using the approximation of a constant interquark potential at low energies. By fitting to the experimental value of f/sub π/, good agreement is found for the constituent mass m/sup */ and the quark condensate <psi-barpsi>. Finite-temperature corrections are included, and it is shown that in this approximation chiral-symmetry breaking persists to all temperatures in the absence of deconfinement.

6688 **Nonperturbative quantum electrodynamics in a photon-condensate background field.** Kikuchi, Y.; Ng, Y.J. (Center for Theoretical Physics, Department of Physics, Texas A&M University, College Station, Texas 77843). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 11, 3578-3581(1 Dec 1988).

Analyses of the Schwinger-Dyson (SD) equation for the fermion self-energy have revealed the existence of a QED ultraviolet nonperturbative fixed point which separates a strong-coupling regime from a weak-coupling regime. Here we study the SD equation in the presence of a weak constant photon-condensate background field. This background field does not seem to affect the fixed point. Better approximations or some more realistic background fields may change the result. The investigation is partly motivated by recent heavy-ion experiments.

6689 **Self-consistent retardation in a three-dimensional relativistic equation.** Crawford, G.A.; Thaler, R.M. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01003). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2989-2992(Dec 1988).

A new technique for approximating solutions of the two-body Bethe-Salpeter equation is presented. Coupled equations for the relative energy dependence and the relative three-momentum dependence of the relativistic T matrix are derived. These equations are solved self consistently for the Wick-rotated T matrix in a simple model problem and the numerical results are compared with exact as well as usual three-dimensional reduction results.

6690 **Supersymmetry and the Dirac equation.** Copper, F.; Khare, A.; Musto, R.; Wipf, A. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Annals of Physics (New York);* **187**: No. 1, 1-28(Oct 1988).

We discuss in detail two supersymmetries of the 4-dimensional Dirac operator D-italic-dash-bar^2 where D-italic-dash-bar = partial-dash-bar-ieA-italic-dash-bar, namely the usual chiral supersymmetry and a separate complex supersymmetry. Using SUSY methods developed to categorize solvable potentials in 1-dimensional quantum mechanics we systematically study the cases where the spectrum, eigenfunctions, and S-matrix of D-italic-dash-bar^2 can be obtained analytically. We relate these solutions to the solutions of the ordinary massive Dirac equation in external fields. We show that whenever a Schroedinger equation for a potential V(x) is exactly solvable, then there always exists a corresponding static scalar field phi(x) for which the Jackiw-Rebbi type (1+1)-dimensional Dirac equation is exactly solvable with V(x) and phi(x) being related by V(x) = phi^2(x)+phi$'$(x). We also discussed and exploit the supersymmetry of the path integral representation for the fermion propagator in an external field. copyright 1988 Academic Press, Inc.

65 PHYSICS II

REFER ALSO TO CITATION(S) 7178

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 6615, 6816

6691 **(DOE/ER/40403—T1) Experimental studies of nucleon-nucleon and pion-nucleus interactions at intermediate energies: Annual progress report, 1988--1989.** (New Mexico State Univ., Las Cruces (USA)). 30 Nov 1988. Contract FG04-88ER40403. 28p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003995/JAW.

This report summarizes the work on experimental research in intermediate energy nuclear and particle physics carried out by New Mexico State University in 1988 under a grant from the US Department of Energy. The nucleon-nucleon research has involved

studies of interactions between polarized neutrons and polarized protons. Its purpose is to help complete the determination of the nucleon-nucleon amplitudes at energies up to 800 MeV, as part of a program currently in progress at LAMPF, as well as to investigate the possibility of the existence of dibaryon resonances. The pion-nucleus research involves studies of this interaction in regions where it has not been adequately explored. These include experiments on elastic and double charge exchange scattering at energies above the {Delta}(1232) resonance, interactions with polarized nuclear targets, and investigations of pion absorption using a detector covering nearly the full solid angle region. 21 refs., 4 figs.

6692 **(ENEA-RT-TIB—87-40) Teseo code validation.** Galli, M.; Fioni, G. (ENEA, Bologna (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 86p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704431/JAW.

In this report some validation tests for the TESEO code are described. The TESEO code was developed at ENEA - Clementel Center in the framework of the C2RV code sequence. This code sequence produces multigroup resonance cross sections for fast reactor analysis. It consists of the codes TESEO, MC/sup 2/-II, GERES, ANISN, MEDIL. The TESEO code processes basic nuclear data in ENDF-B format and produces an ultrafine group (2082 groups) cross section library for the MC/sup 2/-II code. To validate the TESEO algorithms, the data produced by TESEO code were compared with the data produced by other well-tested codes which use different algorithms. No substantial differences was found between these data and the data produced by TESEO code. TESEO algorithms showed high reliability. A detailed study of TESEO calculation options was carried out. Their use and functions are shown to inform the user of the code. 21 refs.

6693 (INIS-SU—68, pp 205) **Actual problems of nuclear spectroscopy.** Mitroshin, V.E. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6694 (INIS-SU—68, pp 344) **Experimental bases for alpha-particle nuclear matter existence.** Ajsina, S.Ya.; Kuterbekov, K.A.; Pavlova, N.N.; Yushkov, A.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6695 (INIS-SU—68, pp 358) **On production mechanism of light fragments in the d+/sup 58/Ni, /sup 64/Cu, /sup 181/Ta reactions at 7.3 GeV.** Kozma, P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6696 (INIS-SU—68, pp 379) **Secondary beams of lightest elements radioactive nuclei in the heavy ion reactions.** Belozerov, A.V.; Borcha, K.; Vintsour, I.; Levitovich, M.; Nguen Khoaj T'yau; Penionzhkevich, Yu.Eh.; Skobelev, N.K.; Chasha, A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6697 (INIS-SU—68, pp 388) **Study on the production cross sections and the characteristics of the radiative decay of total heavy ion fusion reaction products using of VASILISA separator.** Eremin, A.V.; Andreev, A.N.; Bogdanov, D.D.; Kabachenko, A.P.; Orlova, O.A.; Ter-Akop'yan, G.M.; Chepigin, V.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6698 (INIS-SU—68, pp 395) **Properties of high-excited nuclear systems produced in nucleus-nucleus interactions at high energies.** Man'ko, V.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6699 (INIS-SU—68, pp 300) **Determination of spectroscopic factors with account of information on vertex constants.** Gulamov, I.R.; Mukhamedzhanov, A.M.; Ni, G.K. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6700 (INIS-SU—68, pp 304) **/sup 24/Na and /sup 28/Mg emission in relativistic proton reactions.** Kozma, P.; Kliman, J.; Leonard, M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6701 (INIS-SU—68, pp 320) **Isomer ratios of photonuclear reaction yields for some nuclei at E/sub γmax/ = 22 MeV.** Davydov, M.G.; Khamraev, F.Sh.; Shomurodov, Eh.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6702 (INIS-SU—68, pp 372) **Effect of entrance channel on the hard γ-quanta emission.** Kamanin, V.V.; Kugler, A.; Penionzhkevich, Yu.Eh.; Sobolev, Yu.G.; Fomichev, A.S. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6703 (INIS-SU—68, pp 374) **On a possibility of α-particle emission in quasi-fission.** Mezentsev, A.N.; Artyukh, A.G.; Volkov, V.V.; Gridnev, G.F.; Karch, V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6704 (INIS-SU—68, pp 375) **Some peculiarities of evaporated α-particle emission in heavy ion reactions.** Mezentsev, A.N.; Artyukh, A.G.; Volkov, V.V.; Gridnev, G.F.; Karch, V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6705 (INIS-SU—68, pp 376) **Emission of fragments - nuclei of light elements in the /sup 12/C and /sup 52/Cr ion reactions.** Mezentsev, A.N.; Artyukh, A.G.; Volkov, V.V.; Gridnev, G.F.; Karch, V.; Klichevski, S.; Madeya, M.; Shmider, Ya. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6706 **(ORNL/TM—10984) Designing a nuclear data base prototype using Oracle and Prolog.** Paviotti-Corcuera, R.; Ford, C.E.; Perez, R.B. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004306/JAW.

An ever-increasing demand exists for easily accessible nuclear data base systems. The purpose of this work is to analyze the feasibility of using artificial intelligence methods as tools to provide the necessary functionality to extract information from nuclear data files in a user-friendly manner. For the prototype of this work, a sample of data that can be later enlarged to a complete, evaluated nuclear data base has been used. To implement this prototype, two approaches have been followed: a conventional approach using the commercially available Oracle relational data base management system; and an artificial intelligence approach using the Prolog programming language. This prototypic work shows the feasibility of applying artificial intelligence methods to data bases, and represents a first step toward development of intelligent nuclear data base systems. The characteristics of the query language from both approaches make the second one preferable from a user's point of view. 23 refs., 7 tabs.

6511 Experimental Techniques

6707 **(DOE/ER/53179—T8) Nuclear spin-polarized HD, D_2, HT and DT solids, liquids and high density gases: Final report.** Honig, A. (Syracuse Univ., NY (USA). Dept. of Physics). 1988. Contract FG02-84ER53179. 28p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003996/JAW.

Considerable progress has been made during these past 4 years toward achieving metastable, transportable highly spin-polarized deuterium as a first objective along the road to utilization of spin-polarized fusion fuels. We describe the current status of the various components of this problem, including production of superpure o-D_2, development of an NMR probe and sample cell in the dilution refrigerator permitting achievement of sample temperatures down to 10 mK, and NMR and spin relaxation measurements in the mK temperature region on o-D_2 and HD samples at magnetic fields up to 13 Tesla. Also discussed are methods of cold-entry and cold-retrieval via a top-loader system, and techniques relevant to future work, such as sample x-irradiation, and spin-relaxation resulting from phase transitions. Appendices include two reprints (for convenient access to results) and two preprints, which detail some recent developments. 12 refs., 8 figs.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

6708 (INIS-SU—62/A, pp 146-147) **Dp->ppn reaction as an analyzer of deuteron polarization.** Balgansuren, J.; Buzdavina, N.A.; Dirner, A. and others. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The deuteron polarization was estimated from the azimuthal distribution of recoil protons in the dp -> (pn)p reaction. Polarized deuterons were accelerated at the Dubna synchrophasotron, abd a 1 m hydrogen bubble chamber was exposed to this beam. The aim was to perfect the methods of research on polarization phenomena in inelastic nuclear reactions and to estimate the vector polarization of deuterons by fast beam ejection. The analysing power of elastic pp and np reactions reaches its maximum near the chosen values of beam momenta (3.3) GeV/c. The azimuthal distribution of recoil neutrons in the charge exchange channel of the reaction dp -> (pp)n from the same experimental sample is presented. 3 refs.; 1 fig.; 1 tab.

6709 (INIS-SU—62/A, pp 159-161) **Parity violation in the photodisintegration of deuterium.** Donald, A.B.; Schneider, M.B.; Chupp, T.C.; Earle, E.D.; Kidner, S.H.; Clifford, E.H.; Hill, J.J. (Princeton Univ., NJ (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Measurements of the inverse reaction and measurements of the helicity dependence in the cross section for the photodisintegration of deuterium with circularly polarized gamma rays were performed. Measurements were performed at beam energies of 3.2 and 4.1 MeV. Circular polarization for the highest energy bremsstrahlung was measured to be about 30%. The asymmetry in total neutron cross section with gamma ray helicity reversal is (2.7 +-2.8)x10/sup -6/ at 4.1 MeV and (7.7+-5.3)x10/sup -6/ at 3.2 MeV. The asymmetry in bremsstrahlung flux with (3.1+-1.5)x10/sup -6/ at 3.2 MeV. All results are consistent with zero at the two standard deviation level, as predicted theoretically. 5 refs.; 1 fig.

6710 (INIS-SU—68, pp 346) **Study on /sup 4/H resonances in the d+t reaction.** Grantsev, V.I.; Zaritskij, V.S.; Konfederatenko, V.I.; Lashchenov, B.V.; Nemets, O.F.; Pilipchenko, V.A.; Povoroznik, O.M.; Struzhko, B.G. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Båku, USSR (12 Apr 1988).

6711 (INIS-SU—68, pp 380) **Study on the structure of neutron-rich helium isotopes in the heavy ion reactions.** Belozerov, A.V.; Borcha, K.; Vintsour, I.; Dlougy, Z.; Nguen Khoaj T'yau; Penionzhkevich, Yu.Eh. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6712 (INIS-SU—68, pp 277) **Resonance states in the / sup 5/Li and /sup 8/Be excitation range of 30-60 MeV.** Barit, I.Ya.; Zuev, S.V.; Simonov, V.A.; Yasnogorodskij, A.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6713 (INIS-SU—68, pp 296) **Study on the quasi-elastic knock-out reaction of the protons and neutrons on the /sup 4/He, /sup 6,7/Li nuclei at energy of 70 MeV.** Pasechnik, M.V.; Shostak, V.B.; Fursa, A.D.; Palkin, G.P.; Badovskij, V.P.; Likhachev, V.P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6714 **Vector analyzing powers for {sup 1}H(d-italic-arrow-right,{gamma}){sup 3}He and {sup 2}H(p-arrow-right,{gamma}){sup 3}He.** Vetterli, M.C.; Kuehner, J.A.; Bamber, C.; Davis, N.; Trudel, A.J.; Weller, H.R.; Whitton, R.M. (Tandem Accelerator Laboratory, McMaster University, Hamilton, Ontario, Canada L8S 4K1). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 6, 2503-2508(Dec 1988).

The vector analyzing powers for the {sup 1}H(d-italic-arrow-right,{gamma}){sup 3}He and {sup 2}H(p-arrow-right,{gamma}) {sup 3}He reactions have been measured near threshold (E/sub {gamma}/ = 7.5 MeV). The angular distribution of the cross section was also measured for the {sup 2}H(p,{gamma}){sup 3}He reaction. The ratio of the analyzing powers is sensitive to the presence of S = (3/2 capture strength. It was found that a 10% contribution to the capture by M1 radiation (predominantly S = (3/2) is required to explain the data.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

6715 (INIS-SU—68, pp 333) **Investigation on the elastic scattering of /sup 3/He ions in broad range of angles and energies on carbon isotopes.** Adodin, V.V.; Burtebaev, N.T.; Dujsebaev, A.D. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6716 (INIS-SU—68, pp 347) **Kinematically total experiment on the /sup 6/Li and /sup 6/Be three-particle decays.** Bochkarev, O.V.; Korsheninnikov, A.A.; Kuz'min, E.A.; Mukha, I.G.; Chulkov, L.V.; Yan'kov, G.B. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6717 (INIS-SU—68, pp 348) **Polarization of intermediate nucleus in the /sup 7/Li(α,α') /sup 7/Li(4.63 MeV, 7/2/ sup -/)(t)/sup 4/He reaction at E=/sub α/=80 MeV.** Dmitrenko, V.N.; Kozyr', Yu.E.; Sokolov, M.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6718 (INIS-SU—68, pp 350) **Mechanisms of the (d, / sup 6/Li), (d,/sup 7/Li) and (d,/sup 7/Be) reactions on /sup 6/Li and /sup 7/Li nuclei at 50 MeV deuteron energy.** Koshchij, E.I.; Mashkarov, Yu.G.; Rudchik, A.T. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6719 (INIS-SU—68, pp 353) **Search for quasimolecular states of the /sup 14/C+/sup 14/C system in the /sup 14/ C(/sup 18/O,α) reaction.** Aleksandrov, D.V.; Glukhov, Yu.A.; Nikol'skij, E.Yu.; Novatskij, B.G.; Stepanov, D.N.; Venikov, N.I.; Kutyurin, A.V.; Chumakov, N.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6720 (INIS-SU—68, pp 361) **Measurement of spectrum of the /sup 12/C(/sup 6/Li,/sup 7/Be)/sup 11/B reaction under 0/sup 0/ angle.** Buranov, V.V.; Venikov, N.I.; Glukhov, Yu.A.; Dobychin, A.M.; Ogloblin, A.A.; Sakuta, S.B.; Unezhev, V.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6721 (INIS-SU—68, pp 362) **Excited states of /sup 6/ He nucleus observed in the /sup 7/Li(/sup 6/Li,/sup 7/Be)/ sup 6/He reaction under 0/sup 0/ angle.** Buranov, V.V.; Venikov, N.I.; Glukhov, Yu.A.; Dobychin, A.M.; Ogloblin, A.A.; Sakuta, S.B.; Unezhev, V.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6722 (INIS-SU—68, pp 364) **Mechanisms of inclusive reactions of /sup 12/C and /sup 14/N ions with light nuclei.** Ponkratenko, O.A.; Nemets, O.F.; Rudchik, A.T. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6723 (INIS-SU—68, pp 365) **Energy and angular distributions of products of the (/sup 12/C,/sup 7,9/Be) reactions on light nuclei at E(/sup 12/C){similar←to}5 MeV.** Goryunov, O.Yu.; Koshchij, E.I.; Mashkarov, Yu.G. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6724 (INIS-SU—68, pp 366) **On a nature of inclusive spectra of (/sup 12/C,α) reactions on light nuclei at E(/sup 12/C){similar←to}5MeV.** Goryunov, O.Yu.; Koshchij, E.I.; Mashkarov, Yu.G. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6725 (INIS-SU—68, pp 367) **Mechanisms of (/sup 12/ C,Li) reactions on light nuclei at E(/sup 12/ C){similar←to}65 MeV.** Goryunov, O.Yu.; Koshchij, E.I.; Lapchenko, S.Yu. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6726 (INIS-SU—68, pp 381) **Detailed study on d-α correlation functions in the (/sup 6/Li,d) reactions on /sup 12/C and /sup 16/O nuclei.** Artemov, K.P.; Golovkov, M.S.; Gol'dberg, V.Z. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6727 (INIS-SU—68, pp 387) **On search for density isomers in the interaction of relativistic /sup 12/C nuclei with lead.** Avdeev, S.P.; Karnaukhov, V.A.; Kuznetsov, V.D.; Petrov, L.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6728 (INIS-SU—68, pp 275) **Mechanism of cluster knock-out reactions from 1p-shell nuclei by action of 50 MeV protons.** Vdovin, A.I.; Golikov, I.G.; Golovin, A.V.; Zhukov, M.N.; Loshchakov, I.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6729 (INIS-SU—68, pp 276) **Mechanism of the /sup 7/ Li(p,t)/sup 5/Li reaction at energy E/sub p/=12-50 MeV.** Barit, I.Ya.; Zuev, S.V.; Yasnogorodskij, A.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6730 (INIS-SU—68, pp 278) **(p,pN) and (K/sup +/,K/ sup +/N) reactions on the C, N and O nuclei at energies of 170 MeV and 200 MeV respectively.** Berdnikov, Ya.A.; Zajtsev, M.K.; Ostroumov, V.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6731 (INIS-SU—68, pp 279) **(K/sup +/,KN) reaction on C, N, O nuclei at energies of 60-480 MeV.** Berdnikov, Ya.A.; Ostroumov, V.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6732 (INIS-SU—68, pp 288) **Optical potential for description of proton scattering on /sup 13/C nucleus in the energy range of 10-20 MeV.** Goncharov, S.A.; Gulamov, I.R.; Romanovskij, E.A.; Timofeyuk, N.K.; Shitikova, K.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6733 (INIS-SU—68, pp 293) **Production of clusters in multi-particle reactions at π/sup +/- and π/sup -/- meson scattering on nuclei with A=12, ... , 16.** Gismatullin, Yu.R.; Melent'ev, A.A.; Ostroumov, V.I.; Petukhov, A.M.; Stalevich, M.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6734 (INIS-SU—68, pp 294) **Partial cross sections of π/sup -/-meson scattering on /sup 12/C, /sup 14/N, /sup 16/O nuclei with neutron emission.** Gismatullin, Yu.R.; Melent'ev, A.A.; Ostroumov, V.I.; Petukhov, A.M.; Stalevich, M.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6735 (INIS-SU—68, pp 299) **Manifestation of the /sup 10/B, /sup 11,12/C high - excited states in excitation functions of the /sup 9/Be(p,$\alpha\gamma$), /sup 10/B(p,p/sup '/γ), /sup 10/B(p,$\alpha\gamma$) and /sup 11/B(p,p'γ) reactions.** Abramovich, S.N.; Guzhovskij, B.Ya.; Protopopov, V.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6736 (INIS-SU—68, pp 301) **(p,n) reactions and their analysis in the framework of the peripheral model.** Kayumov, M.A.; Krekoten', S.P.; Mukhamedzhanov, A.M.; Khamidova, K.; Yarmukhamedov, R. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6737 (INIS-SU—68, pp 315) **Cluster structure of /sup 6/Li nucleus.** Burkova, N.A.; Zhusupov, M.A.; Ehramzhyan, R.A. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6738 (INIS-SU—68, pp 316) **Excitation of /sup 12/B low-lying levels in the (γ,π/sup +/) reaction on carbon.** Adam, I.; Belov, M.V.; Grigor'ev, A.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6739 (INIS-SU—68, pp 326) **Coulomb interaction of products of the three-particle reaction /sup 10/B(d,3α).** Karmanov, F.I.; Komarov, V.V.; Nemets, O.F.; Pavlenko, Yu.N.; Popova, A.M.; Pugach, V.M.; Shablov, V.L. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6740 (INIS-SU—68, pp 327) **Energy dependence of angular correlation functions in the /sup 10/B(α,dγ)/sup 12/C and /sup 11/B(α,tγ)/sup 12/C reactions.** Ignatenko, A.V.; Lebedev, V.M.; Spasskij, A.V.; Teplov, I.B.; Fateeva, L.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6741 (INIS-SU—68, pp 328) **Angular dependence of density matrix spin-tensors of /sup 12/C nucleus 4,44 MeV state in the (α,dγ) and (α,tγ) reactions on boron nuclei at E/sub α/=25 MeV.** Vasil'eva, O.I.; Gurevich, G.S.; Ignatenko, A.V. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6742 (INIS-SU—68, pp 329) **Observation of nuclear rainbow in the (/sup 3/He,t) reaction.** Dem'yanova, A.S.; Ogloblin, A.A.; Mazurov, I.B. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6743 (INIS-SU—68, pp 331) **Inelastic scattering of /sup 3/He ions on /sup 12/C at 72 MeV with aim of search for rainbow effects.** Goncharov, S.A.; Dem'yanova, A.S.; Ogloblin, A.A.; Lyashko, Yu.V.; Adodin, V.V.; Burtebaev, N.; Gareev, F.A.; Ershov, S.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6744 (INIS-SU—68, pp 377) **Study on the (/sup 7/Li, /sup 6/He) reaction as a source of secondary beam of /sup 6/He nuclei.** Aleksandrov, D.V.; Glukhov, Yu.A.; Nikol'skij, E.Yu.; Novatskij, B.G.; Stepanov, D.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6745 **(JINR-R—1-88-30) Proton and π/sup -/-meson spectra in CC interactions at 4.2 GeV/c per nucleon momentum.** Kanarek, T.; Kladnitskaya, E.N.; Togoo, R.; Toneeva, G.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy; Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1988. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704965/JAW.

Submitted to the journal Sov. J. Nucl. Phys. .

The invariant cross sections of proton and π/sup -/-meson production have been measured at fixed angles in the rest system of the target nucleus versus the momenta of these particles for CC interactions at 4.2 GeV/c per nucleon. The spectra of protons and π/sup -/-mesons emitted at angles, Θ, of >20 deg are described by an exponent of the type σ/sub inv/=Aexp(-P/P/sub 0//sup p(π-)/). The parameters P/sub 0//sup p/ and P/sub 0//sup π-/ decrease with increasing Θ. The values of P/sub 0//sup 3/π/sup -/ are

smaller than those of P/sub 0//sup p/ in the corresponding angular intervals to Θ=70 deg. The values of P/sub 0//sup p/ and P/sub 0//sup π-/ are similar for angles above 70 deg. 15 refs.; 8 figs.; 1 tab.

6746 **Excitation function for the pion single-charge-exchange reaction /sup 13/C({pi}{sup +},{pi}{sup 0})/sup 13/ N (g.s.).** Ussery, L.E.; Vieira, D.J.; Berlijn, J.J.H.; Butler, G.W.; Dropesky, B.J.; Giesler, G.C.; Imanishi, N.; Leitch, M.J.; Rundberg, R.S. (Isotope and Nuclear Chemistry Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2761-2770(Dec 1988).

Angle-integrated cross-section measurements for the reaction /sup 13/C({pi}{sup +},{pi}{sup 0})/sup 13/ N(g.s.), made with activation techniques, are presented for the energy range 50–350 MeV. These results are compared to earlier data for the same reaction and to differential cross-section measurements on other light nuclei. A deep minimum is observed near 70 MeV in the excitation function; it reflects the s- and p-wave interference minimum seen in the free-nucleon single-charge-exchange cross section. The data are compared to several optical-model calculations.

6747 **Angular distributions for /sup 16/O({gamma},p)/sup 15/N at intermediate energies.** Adams, G.S.; Kinney, E.R.; Matthews, J.L.; Sapp, W.W.; Soos, T.; Owens, R.O.; Turley, R.S.; Pignault, G. (Department of Physics, Rensselaer Polytechnic Institute, Troy, New York 12180). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2771-2776(Dec 1988).

The photoproton knockout reaction on /sup 16/O leaving /sup 15/N in low-lying bound states has been observed over the photon energy range from 196 to 361 MeV. The angular distribution for the reaction populating the ground state of /sup 15/N develops sharp structure as the photon energy is increased but that for population of the excited states is smooth. The results are not explained by existing theoretical models.

6748 **Energy dependence of pion inelastic scattering to the 1{sup +} states in /sup 12/C.** Oakley, D.S.; Peterson, R.J.; Rilett, D.J.; Morris, C.L.; Greene, S.J.; Boyer, B.; Johnson, K.; Fuentes, A.H.; McDonald, J.W.; Smithson, M.J.; and others. (University of Colorado, Boulder, Colorado 80309-0446). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2978-2981(Dec 1988).

The energy dependence of cross sections for inelastic pion scattering to the {Delta} = {Delta} = {Delta} = 1 transition at 15.11 MeV in /sup 12/C is found to map very closely the {Delta} = {Delta} = {Delta}+1 {pi}-nucleon scattering cross sections at beam energies from 50 to 295 MeV. This free {pi}-nucleon energy dependence is due to the prominent {Delta}sub 3/2,3/2/ resonance, corresponding to the first excited nucleon state, which is mirrored in the {pi}-nucleus system with little alteration.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

6749 (INIS-SU—68, pp 242) **One-photon positron annihilation in statu nascendi?.** Rad'ko, V.E. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6750 (INIS-SU—68, pp 383) **Diffraction process in the /sup 28/Si(/sup 6/Li,αc)X reaction at 156 MeV.** Vagner, G.; Grabmair, P.; Evlanov, M.V.; Mairle, G.; Knopfle, K.; Pugach, V.; Sigert, G. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6751 (INIS-SU—68, pp 281) **Measurement of sublevel population probability at 2/sub 1//sup +/ level excitation in inelastic proton scattering on /sup 24/Mg.** Lazarev, V.V.; Chubinskij, O.V.; Vinogradov, L.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6752 (INIS-SU—68, pp 286) **Determination and analysis of total cross sections of proton reactions on the /sup 23/Na, /sup 24,25/Mg nuclei in the range of E/sub p/ {similar←to}10MeV.** Romanovskij, E.A.; Khusejn Khamad Abbd; Bespalova, O.V.; Goryaga, N.G.; Galakhmatova, B.S.; Kordyukevich, V.O.; Nguen Mak Kha; Spasskaya, T.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6753 (INIS-SU—68, pp 305) **Wave function of /sup 28/Si resonance obtained from the 6.54 MeV proton interaction with /sup 27/Al.** Mikhaleva, T.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6754 (INIS-SU—68, pp 312) **Comparison of photodisintegration characteristics of nuclei with neutron number N=14.** Gabelko, A.S.; Ishkhanov, B.S.; Kapitonov, I.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6755 (INIS-SU—68, pp 313) **Partial channels of (γ,np) reaction on /sup 27/Al nucleus.** Gabelko, A.S.; Ishkhanov, B.S.; Kapitonov, I.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6515 Nuclear Properties And Reactions, A=39-58, Experimental

6756 (INIS-SU—68, pp 54) **Excitation of the /sup 44mg/Sc and /sup 137mg/Ce isomeric nuclei in the alpha reactions.** Makuni, B.M.; Tulinov, A.F.; Chuvil'skaya, T.V.; Shavtvalov, L.Ya. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6757 (INIS-SU—68, pp 55) **Study on he /sup 49/Ti levels by means of the (γ,γ) reaction.** Begzhanov, R.B.; Kobilov, O.Sh.; Kulabdullaev, G.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6758 (INIS-SU—68, pp 338) **Charge-exchange reaction (/sup 3/He,t) on /sup 54/Fe nucleus at incident helicon energy E=34 MeV.** Kuznichenko, A.V.; Molev, A.S.; Onishchenko, G.M.; Adodin, V.V.; Burtebaev, N.T.; Dujsebaev, A.D.; Ivanov, G.N.; Kanashevich, V.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6759 (INIS-SU—68, pp 354) **Total cross sections of α-particle interaction with Ca.** Dubar', L.V.; Eleukenov, D.Sh.; Nemets, O.F.; Slyusarenko, L.I.; Tokarevskij, V.V.; Yurkuts, N.P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6760 (INIS-SU—68, pp 355) **Interaction of alpha particles with isobars.** Dubar', L.V.; Eleukenov, D.Sh.; Nemets, O.F.; Slyusarenko, L.I.; Tokarevskij, V.V.; Yurkuts, N.P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6761 (INIS-SU—68, pp 307) **Measurement of isomeric ratios for /sup 44m,g/Sc nuclei in the (p,n) reaction.** Gavrilyuk, V.I.; Zheltonozhskij, V.A.; Kharlanov, V.B. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6762 **Isospin splitting of the giant dipole built on the isobaric analog state.** Mordechai, S.; Auerbach, N.; Fortune, H.T.; Morris, C.L.; Moore, C.F. (Ben-Gurion University of the Negev, Beer-Sheva 84105 Israel, University of Texas at Austin, Austin, Texas 78712, and University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 6, 2709-2715(Dec 1988).

We report the first observation of the isospin splitting of the giant dipole resonance built on the isobaric analog state. Three giant resonances were observed in ({pi}{sup +},{pi}{sup -}) double charge exchange (at T/sub {pi}/ = 292 MeV) on /sup 56/Fe at excitation energies of 25.7, 30.0, and 33.5 MeV (Q = -31.4, -35.7, and -39.2 MeV). Angular distributions were measured for the resonances and each observed to have a dipole shape. The cross-section ratios of the resonances are in close agreement with simple isospin geometry arguments for an isovector excitation built on the isobaric analog state. The summed cross section agrees well with simple sequential-model calculations in which the intermediate states arise from single charge exchange to the isobaric analog state and to the giant dipole resonance. We identify the three resonances as the isospin members of the charge-exchange dipole built on the isobaric analog state.

6763 **/sup 43/K({beta}2]) /sup 43/Ca and the structure of /sup 43/K and /sup 43/Ca.** Warburton, E.K.; Alburger, D.E. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] C: Nuclear Physics;* **38**: No. 6, 2822-2837(Dec 1988).

The {beta}2] decay of 22 h /sup 43/K (J/sup {pi}/ = (3/2{sup +}) was reexamined with the main motive of determining the first-forbidden {beta}2] branches to the (3/2{sup -} and (5/2{sup -} states more accurately. The branch to the (5/2{sup -} state at 373 keV was established as 0.9(6)% as opposed to a previous limit of <3%. Other {beta}2] and {gamma} branching ratios and {gamma}-ray energies were determined with considerably improved accuracy. Shell-model calculations in full (2s,1d)/sup 24/(1f,2p){sup 3} and (2s,1d)/sup 23/(1f,2p){sup 4} configurational spaces were carried out using the WBMB spherical shell-model interaction. Energy spectra, nucleon pickup spectroscopic factors from /sup 44/Ca, two-nucleon transfer strengths from /sup 41/K, and {gamma}-ray transition rates were calculated for both /sup 43/K and /sup 43/Ca as well as allowed and first-forbidden decays for the known branches in /sup 43/K({beta}2]) /sup 43/Ca. Results are compared to experiment.

6516 Nuclear Properties And Reactions, A=59-89, Experimental

6764 (INIS-SU—68, pp 57) **Lifetimes of excited states of /sup 66/Ge nucleus investigated by DSA method.** Zhovliev, U.J.; Kudoyarov, M.F.; Kul'dzhanov, I.K.; Muminov, A.I.; Pasternak, A.A.; Pugovkin, A.P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6765 (INIS-SU—68, pp 63) **Multipole mixtures of γ-transitions in /sup 78,80,82/Se nuclei.** Dostemesova, G.A.; Kaipov, D.K.; Kosyak, Yu.G.; Lysikov, Yu.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6766 (INIS-SU—68, pp 336) **Scattering of the 24.4 MeV α-particles on /sup 66/Zn nuclei.** Antropov, A.E.; Pavlov, Eh.L.; Smirnov, A.V.; Gusev, V.P.; Zarubin, P.P.; Kolozhvari, A.A.; Abu Issa, N.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6767 (INIS-SU—68, pp 337) **Investigation of the /sup 66,67,68,70/Zn+ α reactions at α-particle energy of 14-24.4 MeV.** Abu Issa, N.N.; Antropov, A.E.; Gusev, V.P.; Zarubin, P.P.; Smirnov, A.V.; Khrisanfov, Yu.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6768 (INIS-SU—68, pp 356) **Spectroscopic characteristics of proton-hole states from the /sup 70/Ge(d,/sup 3/He)/sup 69/Ga at 52 MeV.** Pugach, V.; Wagner, G.; Woldt, P.; Grabmayr, P.; Kiva, V.; Mauser, G.; Martens, G.; Rainer, K.; Rau, G. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6769 (INIS-SU—68, pp 282) **Manifestation of intermediate structure in /sup 65/Cu.** Parzhitskij, S.S.; Sigalov, V.M.; Sizov, I.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6770 (INIS-SU—68, pp 283) **Spins of nonanalog proton resonances in /sup 65/Cu.** Parzhitskij, S.S.; Sigalov, V.M.; Sizov, I.V.; Sokolov, V.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6771 (INIS-SU—68, pp 284) **Supplementary proof of intermediate structure existence in /sup 63/Cu.** Kraft, O.E.; Sigalov, V.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6772 (INIS-SU—68, pp 291) **Intermediate resonances in elastic neutron scattering on /sup 82/Se.** Musaelyan, R.M.; Popov, V.I.; Skorkin, V.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6773 (INIS-SU—68, pp 295) **Analysis of π,πHe reaction on the Ag, Br nuclei at energy of 170 MeV.** Lantsev, I.A.; Ostroumov, V.I.; Pavlov, A.V.; Pikhtov, S.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6774 (INIS-SU—68, pp 318) **Activation states of /sup 81/Br isomer (T/sub 1/2/=36 μs) in the energy range of 3-4 MeV from photoexcitation by bremsstrahlung.** Dubenskij, A.P.; Dubenskij, V.P.; Bojkova, E.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6517 Nuclear Properties And Reactions, A=90-149, Experimental

6775 (CONF-8806167—5) **Spectroscopic study of sub-barrier quasi-elastic nuclear reactions.** Pass, C.N.; Evans, P.M.; Smith, A.E.; Stuttge, L.; Betts, R.R.; Lilley, J.S.; Connell, K.A.; Simpson, J.; Smith, J.R.; James, A.N. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003624/JAW.

From Symposium on heavy ion interactions around the Coulomb Barrier; Padova, Italy (1 Jun 1988).

The technique developed in this paper is particularly well suited to the detailed spectroscopic study of low energy quasi-elastic nuclear reactions and by overcoming the limitations of conventional procedure, the prospect of detailed studies of inclusive reaction mechanism may be realised. With only limited statistics we find evidence for strong multistep character in the transfer of a single nucleon from spherical vibrational target to spherical projectile nuclei. The suggestive measurements reported here may be made definitive through extended runs based on this technique and experiments planned for the future offer the real prospect of developing a quantified interpretation of the reaction process. 9 refs. 5 figs.

6776 (GSI—88-34(prepr.)) **Bose-Einstein correlations of positive pions in collisions of Nb+Nb and Au+Au at 650 AMeV.** Bock, R.; Claesson, G.; Gutbrod, H.H.; Kolb, B.W.; Schmidt, H.R.; Doss, K.G.R.; Poskanzer, A.M.; Ritter, H.G.; Wieman, H.; Gustafsson, H.A. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Lawrence Berkeley Lab., CA (USA)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Lawrence Berkeley Lab., CA (USA); Lund Univ. (Sweden); Muenster Univ. (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1988. 15p. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

Two-pion interferometry analysis of the Plastic Ball data for Au+Au and Nb+Nb interaction at 650 A MeV kinetic energy is presented. The values of 3.4+-0.4 fm and 4.8+-0.6 fm for pion source sizes and 3.6+-0.8 fm/c and 5.7+-0.7 fm/c for lifetimes are obtained for the Nb+Nb and Au+Au cases, respectively. No significant change in radius as a function of multiplicity has been observed. However, the selection of π/sup +/ with low momenta in the center of mass system reveals an enlarged radius for the Au+Au system but no such increase for Nb+Nb.

6777 (INIS-SU—68, pp 56) **Radiative strength functions of the E1-transitions in nuclei.** Begzhanov, R.B.; Galinskij, E.M.; Kobilov, O.Sh.; Kulabdullaev, G.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6778 (INIS-SU—68, pp 74) **Measurement of charge radii differences for zirconium nuclei by resonance laser fluorescence method.** Gangrskij, Yu.P.; Zemlyanoj, S.G.; Kul'dzhanov, B.K.; Marinova, K.P.; Markov, B.N.; Khoang Tkhi Kim Khueh; Chan Kong Tam. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6779 (INIS-SU—68, pp 82) **Study on the γ-transitions of /sup 106/Cd nucleus in the (n,n'γ) reactions.** Berendakov, S.A.; Govor, L.I.; Demidov, A.M.; Mikhajlov, I.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6780 (INIS-SU—68, pp 92) **Multipole mixtures in γ-transitions of /sup 118/Sn nucleus.** Mikhajlov, I.V.; Demidov, A.M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6781 (INIS-SU—68, pp 94) **On the decay of /sup 139m/Nd (T/sub 1/2/=5.5 hour) and /sup 139/Nd (T/sub 1/2/=30 min).** Islamov, T.A.; Islamova, Kh.M.; Kononenko, G.A.; Makhmud Abdililakh; Choriev, B.Ch. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6782 (INIS-SU—68, pp 99-100) **Scheme of /sup 146/Eu -> /sup 146/Sm decay.** Adam, I.; Zhelev, Zh.T.; Kratsik, B.; Tlusty, P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6783 (INIS-SU—68, pp 236) **Search for (M2+E3)-transition in a decay scheme of /sup 90m/Nb.** Gerasimov, V.N.; Kulakov, V.M.; Pchelin, V.A.; Rodionov, Yu.F.; Chistyakov, L.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6784 (INIS-SU—68, pp 385) **Study on the /sup 90/Zr(/sup 7/Li,/sup 7/Be)/sup 90/Y reaction at E/sub (sup 7)Li/=78 MeV.** Gareev, F.A.; Glukhov, Yu.A.; Goncharov, S.A. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6785 (INIS-SU—68, pp 386) **Measurement of ratio of excited states production cross sections in the /sup 90/Zr(/sup 19/F,p2n)/sup 106/Cd reaction.** Vishnevskij, I.N.; Zheltonozhskij, V.A.; Kharlanov, V.B. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6786 (INIS-SU—68, pp 310) **Excitation functions of the (p, 4pxn) reaction on Zr nuclei at proton energy below 70 MeV.** Gorpinich, O.K.; Kondrat'ev, S.N.; Kuz'menko, V.A.; Lobach, Yu.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6787 (INIS-SU—68, pp 319) **Cross sections of photoactivation reactions for some molybdenum isotopes.** Davydov, M.G.; Trukhov, A.V. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6788 (INIS-SU—68, pp 321) **Cross section of photoexcitation of the /sup 111m/Cd and /sup 199m/Hg isomers.** Bigan, Z.M.; Goshovskij, M.V.; Dzhilavyan, L.Z.; Mazur, V.M.; Popovich, K.D.; Sokolyuk, I.V.; Sychev, S.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6789 (INIS-SU—68, pp 322) **Structure of the (γ,n) reaction cross sections on nuclei with N=82.** Belyaev, S.N.; Erokhin, S.V.; Kozin, A.B.; Nechkin, A.A.; Semenov, V.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6790 (INIS-SU—68, pp 369) **Study on the Li and B isotope yield in interactions of nitrogen ions with /sup 93/Nb and /sup 232/Th nuclei.** Aushev, V.E.; Goryunov, O.Yu.; Zaika, N.I. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6791 (INIS-SU—68, pp 373) **Study on the high - energy γ-quantum spectra in the /sup 22/Ne (178 MeV) reactions.** Kamanin, V.V.; Kugler, A.; Penionzhkevich, Yu.Eh. and others. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6792 **Extended emission sources observed via two-proton correlations.** Awes, T.C.; Ferguson, R.L.; Obenshain, F.E.; Plasil, F.; Young, G.R.; Pratt, S.; Chen, Z.; Gelbke, C.K.; Lynch, W.G.; Pochodzalla, J.; and others. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review Letters;* **61**: No. 23, 2665-2668(5 Dec 1988).

Two-proton correlations were measured as a function of the total energy and relative momentum of the protons. The correlation is analyzed for different orientations of the relative momentum, which allows information on the size and lifetime of the emission source to be extracted. The most energetic particles are emitted from a short-lived source of compound-nucleus dimensions while the lower-energy protons appear to be emitted from a source considerably larger than the compound nucleus.

6518 Nuclear Properties And Reactions, A=150-189, Experimental

6793 (CONF-880496—4) **The g-factor of the K = 25 isomer in {sup 182}Os.** Alderson, A.; Broude, C.; Bruce, A.; Dafni, E.; Fallon, P.; Goldring, G.; Hass, M; Nyberg, J.; Roberts, J.; Sharpey-Schafer, J.; Sletten, G.; Twin, P. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003627/JAW.

From Conference on high-spin nuclear structure and novel nuclear shapes; Argonne, IL, USA (13 Apr 1988).

The g-factor of the K = I = 25, 120 ns isomer in {sup 182}Os has been measured by observing the angular precession of the decay {gamma}-rays in an external magnetic field. Our preliminary result is g = 0.46(5). Comparing this result to predictions based on experimental g-factors of single-particle Nilsson orbitals in this mass region suggests equal contributions of neutron and proton spin to the total spin of I = 25. An attempt has also been undertaken to measure the quadrupole moment of this level by observing the time-dependent quadrupole interaction pattern of Os nuclei recoiling into an Os single crystal. The analysis of the quadrupole moment measurement, as well as a more detailed analysis of the g-factor measurement, is now in progress. 7 refs., 2 figs.

6794 (INIS-SU—68, pp 108-109) **/sup 160/Gd energy levels.** Berzin', Ya.Ya.; Grigor'ev, E.P.; Guseva, T.V.; Tamberg, Yu.Ya. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6795 (INIS-SU—68, pp 110) **Direction correlations in /sup 160/Tb decay.** Akilov, F.S.; Ibragimov, B.; Kul'dzhanov, I.K.; Muminov, A.I.; Razhabbaev, R.; Usmanov, P. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6796 (INIS-SU—68, pp 111) **On the scheme of /sup 163/Dy energy levels.** Kuvaga, I.L.; Bondarenko, V.A.; Prokof'ev, P.T. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6797 (INIS-SU—68, pp 113) **Gamma vibrational band in odd-odd /sup 166/Ho nucleus.** Balodis, M.K.; Afanas'ev, A.V.; Prokof'ev, P.T.; Tamberg, Yu.Ya. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6798 (INIS-SU—68, pp 114) **Gamma radiation intensities in /sup 166m/Ho decay.** Danilenko, V.N.; Kurenkov, N.V.; Malinin, A.B.; Matveev, S.V.; Stepanov, Eh.K. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6799 (INIS-SU—68, pp 115) **/sup 166/Tm beta-decay and /sup 166/Er states.** Adam, J.; Wagner, V.; Zvolska, V.; Zvolsky, J.; Kracik, B.; Fischer, M. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6800 (INIS-SU—68, pp 119) **Determination of internal conversion coefficient of γ-transition with 343 keV on /sup 175/Lu K and L subshells.** Bulgakov, V.V.; Kirishchuk, V.I.; Lashko, A.P.; Stril'chuk, N.V.; Feoktistov, A.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6801 (INIS-SU—68, pp 120) **Internal conversion electrons of γ-transition with 36.4 keV in /sup 175/Ta.** Kirishchuk, V.I.; Lashko, A.P.; Stril'chuk, N.V.; Feoktistov, A.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6802 (INIS-SU—68, pp 122) **Intensive two-quantum cascades in /sup 183/W.** Boneva, S.T.; Vasil'eva, Eh.V.; Popov, Yu.P.; Sukhovoj, A.M.; Khitrov, V.A.; Yazvitskij, Yu.S. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6803 (INIS-SU—68, pp 357) **Isomer ratios in the /sup 181/Ta(α,n)/sup 184/Re reaction.** Vishnevskij, I.N.; Zheltonozhskij, V.A.; Reshit'ko, S.V.; Stepanenko, V.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6804 **Shape coexistence in /sup 189/Tl.** Kreiner, A.J.; Davidson, J.; Davidson, M.; Mosca, H.; Riedinger, L.L.; Bingham, C.R.; Guidry, M.W.; Kahler, A.C. (Departamento de Fisica, Comision Nacional de Energia Atomica, 1429 Buenos Aires, Argentina). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2674-2680(Dec 1988).

High spin states of /sup 189/Tl have been populated through the fusion-evaporation reactions /sup 169/Tm[/sup 24/Mg(125 MeV),4n], /sup 165/Ho[/sup 28/Si(140 MeV),4n], and /sup 175/Lu[/sup 20/Ne(128 MeV),6n] and its subsequent decay studied by in-beam {gamma}-ray spectroscopy techniques. Among the firmly established features there are two band structures resulting from the coupling of the h(9/2 and i(13/2 proton intruder states to the oblate ground-state band of the Hg core. However, above a certain excitation energy both bands show structural changes possibly related to the prolate shaped excited band in /sup 188/Hg. At least for the pi-tildei(13/2 case, coexistence of both shapes is observed.

6805 **Laser spectroscopy of /sup 170/Tm.** Dyer, P.; Bounds, J.A. (Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2813-2817(Dec 1988).

The magnetic moment, quadrupole moment, and isotope shift of the radioactive isotope /sup 170/Tm have been measured by the atomic-beam resonance-fluorescence technique. Hyperfine structures of the 563-, 568-, 590-, and 597-nm transitions were observed with a resolution of 12 MHz. The magnetic moment is found to be {mu}/sup (170)/ = +0.2458(17) {mu}/sub N/; the spectroscopic quadrupole moment, Q/sub s//sup (170)/ = 0.72(5) b. The isotope shifts {delta}3@/sup 169,170/ for the above lines are -469(2), -471(6), +462(6), and -461(8) MHz, respectively.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

6806 **(DOE/ER/40321—3) [Reaction mechanism studies of heavy ion induced nuclear reactions]: Annual progress report.** Mignerey, A.C. (Maryland Univ., College Park (USA). Dept. of Chemistry and Biochemistry). Oct 1988. Contract FG05-87ER40321. 37p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003698/JAW.

A major experiment was performed at the Oak Ridge National Laboratory Holifield Heavy Ion Research Facility in January 1988. The primary goal of the experiment was to determine the excitation energy division in the initial stages of damped reactions. The reaction of ^{35}Cl on ^{209}Bi was chosen because the excited projectile-like fragments would preferentially emit light charged particles and the target-like fragments deexcite via neutron emission. This provides a means by which projectile excitations can be selected over target excitations through detection of light charged particles in coincidence with projectile-like fragments. Two experiments were performed during the past year at the Lawrence Berkeley Laboratory Bevalac in collaboration with the Wozniak-Moretto group. The first was in February 1988 and was a continuation of earlier work on La-induced reactions at intermediate energies. Beams of La with E/A = 80 and 100 MeV were used to bombard targets of C, Al, and Cu. At this time a test run was also performed using the uranium beam to see if the intensity was sufficient to use this very heavy beam for future experiments. The high intensities obtained for uranium showed that it was feasible to extend the studies of inverse reactions begun with the lanthanum beam to a heavier beam. Gold rather than uranium was chosen for our major run in August due to its low fission probability and higher beam intensity. No results are yet available for that experiment.

6807 (INIS-SU—68, pp 311) **Relative cross sections of Au isotope production in (p,n) reaction.** Sergeev, V.O. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

6808 (INIS-SU—68, pp 359) **Excitation functions of /sup 3/He reactions on /sup 235/U nucleus with /sup 237/Pu and /sup 236/Pu yield.** Gedeonov, A.D.; Pelevin, L.A.; Suprunenko, A.N.; Dmitriev, V.D. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6809 (INIS-SU—68, pp 287) **Decay duration of /sup 238/Np nucleus produced in the (p,n) reaction on /sup 238/U.** Melikov, Yu.V.; Platonov, S.Yu.; Tulinov, A.F.; Fotina, O.V.; Yuminov, O.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6810 (INIS-SU—68, pp 415) **Investigation of transition state densities of /sup 238/Np excited nuclei.** Platonov, S.Yu.; Fotina, O.V.; Khajmin, V.A.; Yuminov, O.A. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

6811 **(IYF-R—2-277) Peculiarities in ionic charge distributions of products of uranium 235 and plutonium 239 fission by thermal neutrons.** Belyaev, A.D.; Bikbova, Z.S.; Gajshan, V.L.; Pikul', V.P.; Usmandiyarov, A.M.; Khabibullaev, P.K. (AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704592/JAW.

Measuring of ionic charge distribution of fission products of heavy group in induced thermal neutrons fission of /sup 235/U and /sup 239/Pu at values of kinetic energies and at various thickness has been carried out with the help of mass-spectrometer. The mean values of ionic charges q-bar and half of the width of distributions σsub q/ for fission products 130 < A < 145 have been determined. A fine structure has been found, which dependents on kinetic energies and the thickness of the targets. Also discussed the possible mechanism of the structure. 14 refs.; 5 figs.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 6564, 6566, 6615, 6633, 6634, 6635, 6636, 6655, 6689, 6693, 6759, 6806, 7075

6812 **(ANL-HEP-CP—88-42) Nuclear dependence of structure functions in the shadowing region of deep inelastic scattering.** Berger, E.L.; Qiu, Jianwei. (Argonne National Lab., IL (USA). High Energy Physics Div.). 27 Jul 1988. Contract W-31109-ENG-38. 18p. (CONF-880560—7). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003647/JAW.

From Topical conference on nuclear quantum chromodynamics; Argonne, IL, USA (19 May 1988).

A discussion of nuclear shadowing in deep inelastic lepton scattering is presented. We show that the parton recombination model suggests that shadowing should begin to occur at larger values of Bjorken x as A increases. This expectation as well as that of weak dependence on Q{sup 2}, and the trend of the x dependence of the shadowing phenomenon are consistent with recent data. Shadowing at small x is combined with nuclear bound state effects, responsible for nuclear dependence at larger x, to provide description of the A dependence of the structure function for the entire range of x. 21 refs., 5 figs.

6813 **(BNL—41894) Nuclear physics with strange particles.** Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 28p. (CONF-8807135—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002912/JAW.

From International school of intermediate energy nuclear physics; Venice, Italy (6 Jul 1988).

Recent progress in the understanding of strange particle interactions with nuclear systems is reviewed. We discuss the relative merits of various reactions such as (K^-, π/sup +-/), (π^+, K^+), or (γ, K^+) for hypernuclear production. The structure of /sub Λ/ ^{13}C is analyzed in some detail, in order to illustrate the role of the ΛN residual interaction and approximate dynamical symmetries in hypernuclear structure. Recent results on the single particle states of a Λ in heavy systems, as revealed by (π^+, K^+) reaction studies, are used to extract information on the density dependence and effective mass which characterize the Λ-nucleus mean field. Finally, we develop the idea the K^+-nucleus scattering at low energies is sensitive to the subtle "swelling" effects for nucleons bound in nuclei. 64 refs., 13 figs.

6814 **(CEA-CONF—9461) Coupled channel calculations and computer code ECIS.** Raynal, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1988. 30p. (CONF-880298—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755607/JAW.

From Applied nuclear theory and nuclear model calculations for nuclear technology applications; Trieste, Italy (15 Feb 1988).

The code ECIS has been developed to study polarization effects in inelastic proton scattering around 20 MeV. It takes into account spin-orbit deformation which has large effects on the inelastic analyzing powers. It has been extended to include compound nucleus features and also the Dirac phenomenology which has been used down to 20MeV proton scattering. The code uses an iteration procedure which will be described in details because it is not secure. The convergence of results can be obtained with Pade approximants but there is some numerical limit which must be understood. This iteration procedure is necessary with spin-orbit deformation. We shall give some information on the integration methods in order to show how to check the precision of the results and on automatic search methods on the parameters. ECIS79 was used for heavy ion scattering and included a special method to deal with long range contributions of the Coulomb interaction. This method is used in the Dirac phenomenology, where such problems arise even for neutron scattering if the tensor coupling of the magnetic moment with the Coulomb field is taken into account. In the Schroedinger phenomenology, to which we shall restrict ourselves, such problems arise from the Mott-Schwinger interaction (Coulomb spin-orbit), necessary to describe the polarization in elastic neutron scattering. The method had to be revised for neutron scattering and for Dirac phenomenology. We shall describe briefly its use and also the use of compound nucleus.

6815 **(CONF-880938—4) Models of πNN interactions.** Lee, T.S.H. (Argonne National Lab., IL (USA)). [1988]. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01. Order Number DE89003639/JAW.

From International symposium on mesons and light nuclei; Rez, Czechoslovakia (5 Sep 1988).

A πNN model inspired by Quantum Chromodynamics is presented. The model gives an accurate fit to the most recent Arndt NN phase shifts up to 1 GeV and can be applied to study intermediate- and high-energy nuclear reactions. 20 refs., 2 figs.

6816 **(CONF-8806167—4) Developments in sub-barrier reactions.** Landowne, S. (Argonne National Lab., IL (USA)). [1988]. Contract W-31109-ENG-38. 11p. NTIS, PC A03/MF A01. Order Number DE89003638/JAW.

From Symposium on heavy ion interactions around the Coulomb Barrier; Padova, Italy (1 Jun 1988).

The study of sub-barrier reactions has developed in recent years to include a broad range of interconnected phenomena. The initial discoveries of enhanced sub-barrier fusion cross sections and the attempts to understand them in terms of couplings to other reactions channels have stimulated investigations into all aspects of heavy-ion collisions at low bombarding energies. As a result, new effects have been observed and new ideas are being put forward. The present talk gives an overview of some current themes in this field. Perhaps the most encompassing development is that one can no longer think of the low energy fusion reaction as an isolated phenomenon, since the fusion rates depend crucially on the presence of other reaction channels. Thus, one wants to know what are the properties of these channels and then how to use this knowledge to explain the fusion rates quantitatively. Generally speaking, quite a number of sub-barrier fusion reactions have been measured but the other reactions which occur have been isolated in a relatively few cases. It is also generally true that theoretical sub-barrier fusion calculations have been successful for a limited range of fairly light mass systems. Thus, the field continues to be a challenging area of research. Going beyond the problem of understanding the fusion mechanism, there have been interesting new developments in all of the reaction classes that have been studied at sub-barrier energies, namely, elastic scattering, inelastic excitation, transfer reactions and deep inelastic collisions. A brief discussion of each of these subjects and how they relate to fusion will be given below. In addition, the important subject of compound nuclear spin distributions produced in fusion reactions will be noted. 20 refs., 9 figs.

6817 **(DOE/ER/40417—1) Nuclear structure research at the High Flux Beam Reactor: Progress report for the period February 1, 1988--September 30, 1988.** Brenner, D.S. (Clark Univ., Worcester, MA (USA)). Sep 1988. Contract FG02-88ER40417. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003798/JAW.

The Clark University research program in nuclear structure is a collaborative effort involving Clark University personnel, staff members from Brookhaven National Laboratory and from Ames Laboratory (Iowa State University), and an active participation of foreign scientists. The TRISTAN on-line isotope separator and the

capture γ-ray facility at the HFBR are the experimental foci of the program which has four principal research themes, three involving nuclear structure physics and one directed towards astrophysics. These themes are: the manifestation of the proton-neutron interaction in the evolution of nuclear structure and its relation to collectivity, the appearance and the role of symmetries and supersymmetries in nuclei, the study of new regions of magic nuclei, and the characterization of nuclei important in r-process stellar nucleosynthesis. The activities involving Clark personnel during the eight month period, February 1, 1988 -- September 30, 1988, are summarized below.

6818 **(DOE/ER/40425—237) State densities and spectrum fluctuations: Information propagation in complex nuclei.** French, J.B.; Kota, V.K.B. (Rochester Univ., NY (USA). Dept. of Physics and Astronomy). 1988. Contract FG02-88ER40425. 31p. (UR—1083; CONF-8806278—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002736/JAW.

From Symposium on nuclear and particle physics; Ahmedabad, India (1 Jun 1988).

At excitation energies in nuclei where the state density is unambiguously defined there is a sharp separation between the smoothed spectrum (which defines the density) and fluctuations about it which have recently been studied with a view to understanding some aspects of quantum chaos. We briefly review these two complementary subjects, paying special attention to: the role of the effective interaction in determining the density; the calculation of interacting-particle state and level densities, and of expectation values of interesting operators; the information about the effective nucleon-nucleon interaction which is carried both by the density and the fluctuations. 28 refs., 1 fig.

6819 **(EUR-CEA-FC—1346) Updated evaluation of dielectronic recombination rate coefficients for utilization in impurity transport codes.** Mattioli, M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jun 1988. 46p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756124/JAW.

Dielectronic recombination rate coefficients available in the literature are analysed; when possible these computed rates are compared with experimental values from Tokamak and θ pinch plasmas. The data chosen to the introduced in the Cadarache impurity transport simulation code are presented according to the isoelectronic sequence of the recombining ion for carbon, oxygen, argon, titanium, chromium, iron and nickel.

6820 **(FEI—1856) DIPRES program for calculation of nuclear reaction cross sections in the framework of optical-statistical approach with parametrization of direct process contribution.** Zelenetskij, A.V.; Pashchenko, A.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704439/JAW.

A program for calculation of average in resonance and intermediate structure residual nuclei of particle reaction cross sections with atomic nuclei in the framework of the Weisskopf evaporation model is described. Two cascades of sequence particle emission are considered. Nonequilibrium particle emission is taken into account when calculating the probabilities of the first particle emission. Cross sections and spectra are calculated simultaneously for three types of particles: neutrons, protons and α-particles. 20 refs.

6821 **(FRCEA-TH—80) Study of relativistic heavy ion central collisions.** L'Hote, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). Jan 1987. 271p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756131/JAW.

This thesis is devoted to the study of nuclear collisions between a target nucleus and a projectile nucleus, the latter having been accelerated at energies ranging from 100 to 2000 MeV (Mega-Electronvolts) per nucleon. The main goal of this field is the determination of nuclear matter equation of state at high densities and temperatures. This determination requires the study of central collisions only, that is collisions at small impact parameters. The detector "Diogene" used at the "Saturne" (Saclay, France) accelerator can measure simultaneously the momenta, masses and emission angles of all particles (pions, protons, deuterons ...) emitted in each collision. The pressure effects pre-dicted by the "intra-nuclear cascade" model are discussed. The pion (pi meson) production in relativistic heavy ion collisions is reviewed. Finally, we present the results of pion production measurements, using "Diogene", in collisions between alpha particles and carbon, copper, or lead target nuclei at 200, 400, 600 and 800 MeV per nucleon. The number of pions per collision is studied in relationship with the proton number. This can be explained in terms of compressional energy. The pion multiplicity distributions and the differential cross-sections are also presented.

6822 **(FRCEA-TH—91) From direct to extremely dissipative reactions, system studied: /sup 89/ Y (/sup 19/F, x) y at 140 MeV incident energy.** Suomijaervi, T. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). Jun 1986. 103p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88756137/JAW.

Energy spectra and angular distributions between 10/sup 0/ and 160/sup 0/ laboratory angles have been measured for projectile like fragments originating from the /sup 19/F + /sup 89/ Y reaction measured at 140 MeV /sup 19/F incident energy. Quasi-elastic few nucleon transfer reactions, centered around grazing angle, are interpreted in terms of a direct diffractional transfer model. In backward angle hemisphere completely energy relaxed reaction products are observed. The angular distributions of these fragments are nearly isotropic giving a lifetime of about 10/sup -21/s for the composite di-nuclear system. The excitation functions measured for these extremely dissipative reactions show strong fluctuations whose coherence width is around 200 keV, center of mass. The fluctuations are correlated in atomic number and in detection angle and could be explained by the existence in the entrance channel of overlapping quasi-molecular resonances or doorway states.

6823 **(GANIL-P—88-01) Liquid drop parameters for hot nuclei.** Guet, C.; Strumberger, E.; Brack, M. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France); Regensburg Univ. (DE)). (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). 1988. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756152/JAW.

Using the semiclassical extended Thomas-FERMI (ETF) density variational method, we derived selfconsistently the liquid drop model (LDM) coefficients for the free energy of hot nuclear systems from a realistic effective interaction (Skyrme SkM*). We expand the temperature (T) dependence of these coefficients up to the second order in T and test their application to the calculation of the fission barriers of the nuclei /sup 208/Pb and /sup 240/Pu.

6824 (INIS-SU—43, pp 13-15) **Application of elementary theory of catastrophe to analysis of polarization characteristics of elastic scattering of intermediate energy protons on zero spin nuclei.** Zavarzina, V.P.; Stepanov, A.V. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

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An amplitude of elastic scattering of protons having energy E/sub p/ within the interval of 100 to 1000 MeV on zero spin nuclei is calculated. It is shown that at E/sub p/ {similar←to}200 MeV the actual part of amplitude of scattering with spin flip is highly sensitive to the difference in geometrical parameters of the spin-orbital and central parts of the optical potential due to assembly catastrophe. 12 refs.; 2 figs.

6825 (INIS-SU—43, pp 16-18) **Effect of optical potential shape on polarization characteristics of elastic scattering of intermediate energy protons on nuclei.** Zavarzina, V.P.; Stepanov, A.V. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

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Polarization characteristics of elastic scattering P and Q for protons with 200 MeV energy on /sup 40/Ca and /sup 208/Pb nuclei are calculated for two models of optical potential (OP). It is shown that these characteristics are sensitive to the OP form. The causes of violation of the applicability conditions for the Keler-Levintov theory are investigated. 6 refs.; 2 figs.

6826 (INIS-SU—43, pp 39-41) **Analysis of peculiarities of polarization characteristics of elastic scattering of protons on /sup 12/C nucleus at the energies E/sub p/=400-600 MeV.** Zavarzina, V.P.; Stepanov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

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Within the framework of optical model with phenomenological and microscopic potentials the amplitude of scattering, polarization and spin flip functions for elestic scattering of protons at E/sub p/=400-600 MeV on a nucleus are calculated. The sensitivity of elastic scattering amplitude to the optical potential parameters is studied. 6 refs.; 1 fig.

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6999 **(JINR—R-4-87-889) Method of projecting operators in the two-rotor model.** Briancon, Ch.; Mikhajlov, I.N.; Usmanov, P.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 23p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704642/JAW.

Submitted to the journal Yad. Fiz.

The method developed by Feshbach of projecting the full space of states onto the part (P) of low-lying states and excluding the complementary part (Q) is used within the two-rotor model. The formulae are obtained for the probabilities of E2- and M1 transitions. The calculations of the spectra and of the transition rates are given for the /sup 230/Th nucleus. It is shown that the E2-transitions are not very much influenced by the effects of coupling with the high-energy states, while for the M1-transitions such effects play a ptincipal role. The agreement between the calculated prob-

abilities of E2-transitions and the experimental data is reasonable. 23 refs.; 5 figs.; 6 tabs.

7000 **(JINR-E—4-87-822) Total kinetic energies of the deep inelastic heavy-ion collision fragments and quasi-fission.** Jolos, R.V.; Permyakov, V.P.; Nasirov, A.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics; AN Uzbekskoj SSR, Tashkent. Inst. Yadernoj Fiziki). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704617/JAW.

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The most probable total kinetic energies for the heavy-ion collision fragments are considered. The influence of the fragment dynamical deformation, nucleon transfer and the neck formation on the scission configuration of the double nuclear system is analysed. It is shown that the dynamical deformation of the fragments on the way to scission and the nucleon transfer cannot explain the observed dependence of the most probable kinetic energies of the fragments on the exit channel mass asymmetry. The inclusion of the neck formation into consideration gives a possibility of reproducing the experimental data on the kinetic energies for heavy composite systems with the total charge Z {similar←to}100. 8 refs.; 2 figs.

7001 **(KFKI—1988-30/A) Anisotropic nuclear matter with momentum-dependent interaction.** Kaempfer, B.; Lukacs, B.; Wolf, Gy. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1988. 15p. NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704968/JAW.

A thermodynamically consistent nonthermal equation of state is presented for nuclear matter with momentum-dependent interactions in a state of anisotropic momentum distribution (expected in >2 GeV/nucleon beam energy heavy ion collisions). As an application the phase diagram for deconfinement transition of interpenetrating nuclear matter currents was constructed.

7002 **(LA-UR—88-3568) T-violation in nuclear interactions: An overview.** Herczeg, P. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 19p. (CONF-8808161—3). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002298/JAW.

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We discuss time-reversal-violation in the nucleon-nucleon interaction, both parity-conserving and with simultaneous parity violation, and consider its effects in some low-energy nuclear processes. 59 refs.

7003 **{Lambda}nucleus single-particle potentials.** Millener, D.J.; Dover, C.B.; Gal, A. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2700-2708(Dec 1988).

Data on the level spectra of {Lambda}hypernuclei, obtained from ({pi}{sup +},K{sup +}) and (K{sup -},{pi}{sup -}) reaction studies, are analyzed to obtain a density-dependent and nonlocal {Lambda}nucleus potential. We relate our results to previous work which bears on the origin of the density dependence and nonlocality of the {Lambda}nucleus potential. We argue that the distinguishable {Lambda}particle provides one of the best examples of single-particle shell structure in nuclear physics.

7004 **Core polarization effects in sd-shell nuclei and charge-symmetry breaking in the nuclear mean field.** Auerbach, N.; Bartel, J.; Wenes, G. (School of Physics and Astronomy, Tel Aviv University, Tel Aviv 69978, Israel). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2921-2927(Dec 1988).

The proton and neutron densities and nuclear potentials are calculated for the deformed sd-shell nuclei /sup 28/Si and /sup 32/S in the framework of the constrained Hartree-Fock method and compared with the results of the spherical nucleus /sup 40/Ca. Coulomb core polarization effects are responsible for differences in the proton and neutron Hartree-Fock potentials. These charge-asymmetry effects in the nuclear mean field must be taken into account when trying to decide whether the charge asymmetry observed in proton and neutron scattering is due to a genuine charge asymmetry in the nuclear force and, if possible, to put an upper limit on the magnitude of this effect. Our calculations indicate that there is no enhancement of the charge asymmetry due to nuclear deformation. The often proposed volume integral of the nuclear potential is found not to be an appropriate tool to investigate charge-asymmetry effects in nuclei due to a large cancellation in the integral.

7005 **Dileptons as a probe of pion, kaon, nucleon, and antinucleon dynamics in nuclear matter.** Gale, C.; Kapusta, J. (Atomic Energy of Canada, Ltd., Theoretical Physics Branch, Chalk River Nuclear Laboratories, Chalk River, Ontario, Canada K0J-1J0). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2659-2663(Dec 1988).

We continue our study of dilepton radiation from high-temperature nuclear matter by computing the rates for the annihilations K{sup +}K{sup -}{yields}e{sup +}e{sup -} and NN-bar{yields}e{sup +}e{sup -}. In general this radiation would yield information on the abundances of kaons and antinucleons in hot and dense nuclear matter. More specifically, the former may yield information on the approach to kaon condensation, and the latter may yield information on the nucleon-antinucleon dispersion relations as predicted by relativistic field theories of nuclear matter. However, these yields are mostly overshadowed by the processes np{yields}npe{sup +}e{sup -} and {pi}{sup +}{pi}{sup -}{yields}e{sup +}e{sup -}, so that dilepton production remains essentially a probe of pion dynamics in the nuclear medium.

7006 **Single-particle potential in dense nuclear matter.** Wiringa, R.B. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2967-2970(Dec 1988).

The single-particle potential in nuclear matter is calculated microscopically for several Hamiltonians for densities ranging from 0.1 to 0.5 fm/sup -3/. These Hamiltonians include nucleon-nucleon potentials fit to scattering data and three-nucleon potentials fit to the binding energies of few-body nuclei and saturation properties of nuclear matter. The single-particle potential is a key ingredient in Boltzmann-Uehling-Uhlenbeck simulations of heavy-ion collisions. Parametrizations of the density and momentum dependence of the single-particle potential that may be useful in such simulations are discussed and compared to phenomenological prescriptions currently in use.

7007 **Comparison of average s-wave resonance spacings from proton and neutron resonances.** Vonach, H.; Uhl, M.; Strohmaier, B.; Smith, B.W.; Bilpuch, E.G.; Mitchell, G.E. (Institut fuer Radiumforschung und Kernphysik, Universitaet Wien, Vienna, Austria). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2541-2549(Dec 1988).

Average s-wave resonance spacings were derived from high-resolution proton resonance data for 11 odd-Z nuclei in the mass range A = 41–67 and compared with the average s-wave spacings obtained from neutron resonances for their odd-N isobars. After careful correction for missing levels the neutron and proton results are consistent; proton resonance data can be used to increase the data base for nuclear level densities. After correction to a common excitation energy, the spacings show a correlation with the shell correction energy E/sub shell/, especially for A = 41, 55, and 59, where data exist for three isobars with quite different shell correction energies. The dependence of the average level spacing D-bar on E/sub shell/ is approximately exponential, in good agreement with the theoretical models of Ignatyuk et al. and Kataria et al. The data also have been used to calculate asymptotic a parameters in these two models. The mass dependence of these parameters can be described by the simple relation a = 0.137A with an rms deviation of 4.3%. Attempts to describe the data within the Fermi gas model resulted in much larger fluctuations of the parameters with A and Z. Finally, the data were compared to the predictions of the microscopic Fermi gas model, using the single particle level scheme of Seeger and Perisho. At present, the quality of this description is still somewhat worse than with the phenomenological models of Ignatyuk et al. and Kataria et al.

7008 **Neutron-/sup 40/Ca mean field between -80 and +80 MeV from a dispersive optical-model analysis.** Johnson, C.H.; Mahaux, C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2589-2609(Dec 1988).

The n-/sup 40/Ca complex mean field is derived from a dispersive optical-model analysis of the available experimental cross sections. In this analysis the real part of the mean field contains dispersive contributions which are derived from the imaginary part by means of a dispersion relation. These dispersive contributions must be added to the Hartree-Fock potential which is assumed to have a Woods-Saxon shape, with a depth V/sub H/(E) that depends exponentially upon energy. The input experimental data are 14 differential cross sections in the energy domain (5.3, 40.0 MeV), five polarization cross sections in the domain (9.9, 16.9 MeV), and the total cross section in the domain (2.5, 80 MeV).

7009 **Transport description for capture processes in nuclear collisions.** Ayik, S.; Shapira, D.; Shivakumar, B. (Tennessee Technological University, Cookeville, Tennessee 38505). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2610-2620(Dec 1988).

A transport theory is developed for description of capture processes in low-energy nuclear collisions. It is based on the picture that a dinuclear molecular complex formed during early stages of the collision acts as a doorway configuration toward formation of a fully equilibrated compound nucleus, and this complex can decay into open binary channels while it evolves toward a compound nucleus. The evolution of the dinuclear molecular complex and its decay into binary fragmentation channels are determined by two coupled transport equations. The formalism, in a local equilibrium limit, is successfully applied to analyze complex fragment emission and fusion-evaporation data from collisions of Si+C, Si+N, and Mg+C.

7010 **Entropy from fragment yields in nucleus-nucleus collisions around 100 MeV/nucleon.** Csernai, L.P.; Fai, G.; Westfall, G.D. (National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2681-2685(Dec 1988).

Recent experimental data for light particle and complex fragment emission are compared to the results of a microcanonical statistical fragmentation model. The entropy produced in the reactions is extracted by varying the breakup temperature and density. The best fit to the data is nearly independent of the temperature and density. The extracted entropy is somewhat higher for light particles than for complex fragments.

7011 **Multiple scattering description of intermediate energy deuteron-nucleus elastic scattering.** Ray, L. (Department of Physics, University of Texas at Austin, Austin, Texas 78712). *Physical Review* [*Section*] *C: Nuclear Physics;* **38**: No. 6, 2743-2755(Dec 1988).

The nonrelativistic multiple scattering formalism of Watson and Kerman, McManus, and Thaler is applied to the deuteron-nucleus elastic scattering system. An optical potential is constructed to second order in the nucleon-nucleon effective interaction t matrix and is organized in such a way that the usual Watanabe folding potential appears as the leading term. The Watanabe folding potential is constructed by integrating nucleon-nucleus optical potentials evaluated at half the deuteron incident kinetic energy over the deuteron s-state wave function. Corrections to the folding potential are identified which arise from deuteron-nucleon double scattering effects, the deuteron d state, virtual deuteron breakup, additional nuclear medium effects, additional target nucleon correlation effects, and relativistic processes. Many of these corrections do not appear in folding model approaches based on effective, rather than microscopic, deuteron-nucleus Hamiltonians. These additional multiple scattering corrections are second order in the nucleon-nucleon t matrix as is the case for the virtual deuteron breakup process which is often included in numerical calculations. Estimates of several of these additional multiple scattering corrections are provided for 700 MeV deuteron-nucleus elastic scattering. Most are found to be quite small. However, the additional effects of the nuclear medium beyond that already included in the input nucleon-nucleus optical potentials are significant and are comparable in magnitude to the effects of virtual deuteron breakup. It is intended that this multiple scattering approach be applied to deuteron-nucleus elastic scattering at energies of several hundred MeV.

7012 **Interacting Boson-Fermion model of collective states IV. The Su(3) x U(2) limit.** Bijker, R.; Kota, V.K.B. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104; and Bartol Research Institute, University of Delaware, Newark, Delaware 19716). *Annals of Physics (New York);* **187**: No. 1, 148-197(Oct 1988).

The dynamic Bose--Fermi symmetries connected with the SU(3) limit of the interacting boson model are discussed in detail. They arise whenever the odd nucleon can occupy all single particle orbits in an oscillator shell with quantum number n, j = n+1/2, n-1/2,...,1/2. Closed expressions for energies, electromagnetic transition rates and moments, and (one and two)= nucleon transfer reaction intensities are derived and compared to a description of deformed odd-even nuclei in terms of the Nilsson model. It is suggested that the nuclei /sup 185/W and /sup 169/Tm provide experimental evidence for this type of symmetry in nuclei. copyright 1988 Academic Press, Inc.

7013 **Studies of the nuclear single-particle response function in a simple model.** White, G.D.; Davies, K.T.R.; Siemens, P.J. (Oak Ridge National Laboratory, Oak Ridge, Tennesse 37831--6373 and University of Tennessee, Knoxville, Tennessee 37996--1200). *Annals of Physics (New York);* **187**: No. 1, 198-246(Oct 1988).

An expansion for the single-particle response function for a collection of non-interacting fermions in a localized potential well is developed with particular emphasis on applications to nuclei (including {Delta}hole excitations), computational techniques, and comparisons to an infinite Fermi gas. Ground states and excited systems can both be treated with this formalism, although the latter involves a significantly more difficult analysis. Also, a useful dispersion relation is obtained for the response function. Then, an accurate method is presented for evaluating bound state and continuum single-particle wave functions in momentum space, the representation in which one most naturally derives the appropriate single-particle normalization factors. However, it is argued that for calculating folding integrals of two single-particle wave functions coordinate space may be superior to momentum space. Our main results show that for any reasonable description of light nuclei excited by pions, the continuum states must be included. Also, in these systems the overall response of the continuum states is dramatically dependent on the real part of the {Delta}particle optical potential. copyright 1988 Academic Press, Inc.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 6002

7014 **(CEA-tr—2198) Kerma factors in interaction of neutrons with boron carbide.** Bondarenko, I.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1986. 10p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755461/JAW.

Heat generation in neutron interactions with boron carbide B/sup 10/; B/sup 11/ and /sup 12/C is calculated. Kerma-factors (kerma-kinetic energy released in materials) were calculated for neutron energies between 10/sup -4/ eV and 15 MeV. No major simplifying assumptions are introduced, and the accuracy of the calculated kerma-factors depends only on availability and accuracy of the basic nuclear data. The ENDF/B-4 data and recent experimental information are used for the calculation of kerma-factors. Plots of these kerma-factors are presented in units of eVxb/atom and wtxsec/(cmxn) as a function of neutron energy.

7015 **(FEI—1790) Measurement of attenuation mass coefficients of 122-136 keV γ radiation of cobalt-57 nuclide.** Zatolokin, B.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1986. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704946/JAW.

The measurement results of mass attenuation coefficients of 122.06-136.47 keV gamma-radiation of cobalt-57 nuclide are given. The measurements are carried out for 19 elements (Be, Al, Ti, V, Cr, Fe, Ni, Cu, Zn, Zr, Nb, Mo, Ag, Cdm Sn, Ta, W, Pt, Pd) as well as for fluoroplastic-4 and acrylic plastic under good geometry conditions. Gamma-radiation was recorded by a scintillator with NaJ(Ti) crystal. The mean-square error of mass attenuation coefficient determination does not exceed 1% at confidence level P=0.68. The data obtained can be used when developing the production structure and practice of radiation nuclide sources, as well as for element analysis based on gamma-radiation absorption. 3 refs.; 6 figs.

7016 **(FRNC-TH—3324) Neutronics equations: Positiveness; compactness; spectral theory; time asymptotic behavior.** Mokhtar-Kharroubi, M. (Paris-13 Univ., 93 - Saint-Denis (France)). Dec 1987. 322p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756144/JAW.

Neutronics equations are studied: the continuous model (with and without delayed neutrons) and the multigroup model. Asymptotic descriptions of these equations ($t->+\infty$) are obtained, either by the Dunford method or by using semigroup perturbation techniques, after deriving the spectral theory for the equations. Compactness problems are reviewed, and a general theory of compact injection in neutronic functional space is derived. The effects of positiveness in neutronics are analyzed: the irreducibility of the transport semigroup, and the properties of the main eigenvalue (existence, nonexistence, frame, strict dominance, strict monotony in relation to all the parameters). A class of transport operators whose real spectrum can be completely described is shown.

7017 **(JAERI-M—88-131) Ultra-cold neutron equipments for fundamental research.** Kawabata, Yuji. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 141p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755515/JAW.

The scope of this study extends from the generation of ultracold neutron (UCN) to the equipments of UCN for fundamental researches. The points written below have been discussed in this study. 1) The characteristics of the supermirror neutron turbine, which is a kind of UCN generator, have been analyzed by numerical calculations, and verified by the experiments. The results have pointed out some improvements and indication for the design of neutron turbine. 2) The feasibility of the multilayer thin film filter monochromator for UCN was studied. It is a new proposal for UCN monochromator. 3) The properties of very-cold neutron (VCN) guide tube was studied numerically. It feeds VCNs to the supermirror neutron turbine. 4) The fall-focussing gravity spectrometer for UCN scattering experiments was studied. New structure was proposed and its efficiency was analyzed numerically. 5) It is an important task to reduce the hydrogen concentration on the neutron mirror surface. Therefore, the hydrogen concentration on the surface of the neutron bottle materials were studied experimentally by Elastic Recoil Detection Analysis of accelerated heavy ion beam.

7018 **(JAERI-M—88-160) Full reflector thickness and isolation thickness on neutron transport.** Sakai, Tomohiro; Naito, Yoshitaka; Komuro, Yuichi. (Japan Information Service, Ltd., Tokyo (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 41p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755526/JAW.

A method to determine "full reflector thickness" and "isolation thickness", which is utilized for criticality safety evaluation on nuclear fuel facilities, was proposed in this paper. Firstly, a calculation was tryed to obtain the two kinds of thicknesses from the result of criticality calculations for a specific case. Then, two simple equations which calculates the two kinds of thicknesses were made from the relation between reflector (or isolator) thickness and k/sub eff/, and one-group diffusion theory. Finally, we proposed a new method to determine the thicknesses. From the method we proposed, "full reflector thickness" and "isolation thickness" can be obtain using the equations and migration length of the reflector (or isolator) and infinite and effective multiplication factor of the fuel.

7019 **(LA—11358-PR) Radiation transport: Progress report, 1 October 1987--31 December 1987.** O'Dell, R.D.; Byers, H.M. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 35p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004143/JAW.

Progress in radiation transport research and development by Los Alamos National Laboratory's Group X-6 during the first quarter of FY88 is reported. Included are unclassified tasks in the areas of Monte Carlo Radiation Transport, Cross Sections and Physics, and Deterministic Radiation Transport. 39 refs., 7 figs., 1 tab.

7020 **Phase anholonomy in the classical adiabatic motion of charged particles.** Littlejohn, R.G. (Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *A: General Physics;* **38**: No. 12, 6034-6045(15 Dec 1988).

The classical adiabatic motion of charged particles in strong magnetic fields, otherwise known as guiding center motion, exhibits an anholonomic phase similar to Berry's phase and the phase discovered in a general context by Hannay. Analysis of this effect reveals that there often is no best way to define the gyrophase when magnetic field lines are curved. Instead, a change in the definition of the phase is a kind of gauge transformation, the study of which leads to new insight into guiding center theory. The path-dependent phase that occurs in this problem is coupled with the metrical structure of physical space, giving rise to a transport process for vectors and frames which is similar to parallel transport in non-Euclidean geometry. Strong analogies with Fermi-Walker transport and Thomas precession in special relativity are pointed out.

6550 Medical Physics

7021 **(BARC—1412) Manual of dose evaluation from atmospheric releases.** Hukkoo, R.K.; Bapat, V.N.; Shirvaikar, V.V. (Bhabha Atomic Research Centre, Bombay (India). Fuel Reprocessing Div.). (Bhabha Atomic Research Centre, Bombay (India)). 1988. 416p. NTIS (US Sales Only), PC A18/MF A01. Order Number DE88704414/JAW.

Nuclear facilities are potential sources of release of radionuclides to atmosphere. The release may be a routine one as a part of gaseous radioactive effluents or unintentional one as due to accidential situations. These releases, however, result into radiological doses to the population arising out of passage of and submersion into radioactive cloud, inhalation of radionuclides, and contaminated food chain. This manual has been prepared to serve as a reference book for computation and evaluation of doses from atmospheric releases of radionuclides from nuclear facilities. The various steps in the dose evaluation and the scheme of computation of external gamma dose, immersion beta-dose and inhalation dose are described. Plume gamma doses are compiled using the actual conical shape of the plume and Pasquill-Gifford dispersion model. Utility tables are given for unit release and unit wind speed. The tables are divided into two categories: those giving gamma-dose from the plume and those involving the ground level concentration. The doses and concentration have been given for 21 distances varying from 0.1 to 100 kms, 10 heights ranging from 0.0 to 200 meters and ten gamma energies ranging from 0.150 to 3 MeV. The concentration distribution and external gamma-dose in a short term plume due to short term releases and those due to continuous releases, hence giving rise to long term concentrations, are given in a separate set of tables. For computation of doses through inhalation route, through immersion route and ingestion route via ground contramination, data from ICRP-30 for a few radionuclides are tabulated. The effect of site topography is introduced as correction fac-

tors. Sampling time correction factors are also introduced. (M.G.B.).

7022 **(EUR—11251) Application of the Alara principle to the occupationally exposed workers in nuclear power plants.** Mueller, W.; Haider, G. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (DE)). (Commission of the European Communities, Luxembourg). 1988. 108p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755647/JAW.

This report sets down how the Alara (as low as reasonably achievable) principle is applied in radiation protection of the occupationally exposed personnel at light-water reactors in EC countries. In some instances the practices, experiences and results from EC countries are supplemented by the practice in other States (e.g. USA, Sweden). Commencing with a short summary of the legal situation in the Member States of the European Community with regard to Alara, the report describes the framework in which the optimization practice has been developed. The main chapters elaborate in detail how the Alara principle has been put into practice in design and operation in LWRs. The importance of qualification and training of power-plant personnel in relation to optimization of radiation protection is considered and some comparisons are drawn with the US practice. Recommendations are made where reason for modification or harmonization of practices is seen in the conclusions of the different chapters and the overall conclusions and summary of the report.

7023 **(INIS-BR—1334) Course on dosimetric protocols.** (Instituto Nacional do Cancer, Rio de Janeiro, RJ (Brazil); Instituto de Radioprotecao e Dosimetria, Rio de Janeiro, RJ (Brazil); Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro (Brazil). Secretaria Regional Centro-Sudeste). 1988. 340p. (In Portuguese). (CONF-8805225—). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704793/JAW.

From 1. meeting on medical physics; Rio de Janeiro, Brazil (23 May 1988).

Several papers about dosimeters calibration are presented. The emphasis is given to the quality control for clinical dosemeters. The calibration necessary for Secondary Standard Pattern Laboratory are shown and the installations and shields for an linear accelerator room are cited. (E.G.).

7024 (INIS-BR—1334, pp 88-107) **Metrology network of ionizing radiation.** Almeida, C.E. de. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704793/JAW. (CONF-8805225—).

From 1. meeting on medical physics; Rio de Janeiro, Brazil (23 May 1988).

A study about calibration standards for ionizing radiation is presented, to keep the quality of the used systems. The main developments at Instituto de Radioprotecao e Dosimetria (IRD), Instituto de Pesq. Energeticas e Nucleares (IPEN) and at the Instituto do Cancer do Ceara (ICC) are shown. (E.G.).

7025 (INIS-BR—1334, pp 110-121) **Dosemeter calibration in X-ray and in cobalt-60.** Silva, T.A. da. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704793/JAW. (CONF-8805225—).

From 1. meeting on medical physics; Rio de Janeiro, Brazil (23 May 1988).

Some tests about quality security for clinical dosemeter calibration in secondary standard dosimetry laboratory are described. The tests in gama calibration system, in X-ray calibration, in secondary standard dosimeter, in the dosemeter that will be calibrated, during the calibration and after the calibration are shown. (C.G.C.).

7026 (INIS-BR—1334, pp 123-129) **Quality control for dosemeters.** Di Prinzio, R. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704793/JAW. (CONF-8805225—).

From 1. meeting on medical physics; Rio de Janeiro, Brazil (23 May 1988).

Several tests and intercomparison of the secondary standard dosemeter calibration in Rio de Janeiro are described. Periodical tests, such as leakage current and the comparison between the secondary standard dosemeter in Rio de Janeiro e Sao Paulo are shown. (E.G.).

7027 (INIS-BR—1334, pp 255-267) **Uncertainty.** Silva, T.A. da. (Instituto de Radioprotecao e Dosimetria, Rio de Janeiro (Brazil)). 1988. (In Portuguese). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704793/JAW. (CONF-8805225—).

From 1. meeting on medical physics; Rio de Janeiro, Brazil (23 May 1988).

The comparison between the uncertainty method recommended by International Atomic Energy Agency (IAEA) and the and the International Weight and Measure Commitee (CIPM) are showed, for the calibration of clinical dosimeters in the secondary standard Dosimetry Laboratory (SSDL). (C.G.C.).

7028 **(KURRI-TR—301) Records of radiation control division, No.23 (1986).** Ishida, M.R.; Kikuchi, Tadatoshi; Tsujimoto, Tadashi and others. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Mar 1988. 74p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755528/JAW.

This report is the summary of activity of the Division of Radiation Control of the safety management in FY 1986, (from Apr. 1986 to Mar. 1987). This report describes the records of the radiation control tasks by the three section of the Division, Indoor Radiation Control, Field Radiation Control and Personnel Radiation Control. External doses and radioactivity concentrations in the water and the air were monitored continuously and the data were acquired. Report on the meteorological data and the environmental radioactive concentration are described. In this report, a number of unscheduled tasks, are also described. The records of the control of personnel radiation exposure and education to new staffs of the institute and researchers were described.

7029 **(PNCT-N—8410-87-17) ORION-II: a computer code to estimate environmental concentration and dose due to airborne release of radioactive material.** Shinohara, Kunihiko; Narita, Osamu; Asano, Tomohiro. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). May 1987. 72p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755529/JAW.

A computer code ORION-II has been developed to estimate environmental concentration and dose due to airborne release of radioactive material from multiple sources of nuclear fuel cycle facilities. The modified Gaussian plume model is applied to calculate atmospheric dispersion. The plume depletion models such as gravitational settling, dry deposition, precipitation scavenging and radioactive decay are considered as the causes of the depletion and deposition on the ground and vegetation. Dose to the public is calculated as an individual dose. Inhalation and oral intake are considered as internal pathways. Submersion in the radioactive cloud and external exposure to ground surface contamination are considered as external pathways. ORION-II is the updated version of ORION code (PNCT N841-83-42) and is appricable to the case study of environmental assessment for the nuclear fuel cycle facilities. ORION-II is written in FORTRAN-IV language and can be run on IBM 360, 370, 303X, 308X, 43XX and FACOM M-series computers.

7030 **(PNCT-N—8530-87-06) Environmental monitoring at Tokai Works, PNC.** Narita, Osamu; Ishida, Junichiro; Asano, Tomohiro. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Dec 1987. 39p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755530/JAW.

Safety is the most important in the processes of developing nuclear fuel cycle technology. Especially, the public safety around the nuclear facilities is the top priority. We should design, construct and operate the nuclear facilities in conformity to the principle of

"defence in depth" to keep the public safety and health. Effluent monitoring is performed to assess effectiveness of safety design and adequacy of plant operation. In addition, environmental monitoring is carried out to confirm the public and environmental safety. This report summarizes the activities of the Environmental Protection Section at Tokai Works.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 6175, 6180, 6180, 6206, 6627, 7125

7031 **(BNL—41834) Spin dynamics in CoCl{sub 2} - intercalated graphite.** Wiesler, D.G.; Zabel, H.; Shapiro, S.M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-8811108—1). NTIS, PC A03/MF A01. Order Number DE89002906/JAW.

From MRS symposium on graphite intercalation compounds: science and applications; Boston, MA, USA (28 Nov 1988).

Here we present some results of an investigation into the magnetic excitations and fluctuations of stage 2 CoCl{sub 2}-GIC by inelastic neutron scattering. Data were taken with the triple axis spectrometer at beam line H7 of the High Flux Beam Reactor at Brookhaven National Laboratory. We used fixed 4.6 MeV initial energy neutrons and 40' collimations to give an energy resolution of about 0.13 MeV FWHM. The sample consisted of many small Kish-graphite based crystals and had a crystal texture similar to that of PG, with random in-plane orientation and a c{asterisk}-axis mosaic spread of about 9{degree}. Sample temperatures down to 4.5 K were attained in a He-4 cryostat, which for the field-dependent measurements was outfitted with a magnet providing a vertical field of up to 1.5 k0e along one of the in-plane axes. The data presented below were measured with the scattering vector Q held constant while the energy transfer {Dirac+-h}{omega} was varied. We have taken data for Q = (q 0 0.5), with excitation wave vector q measured relative to the CoCl{sub 2} unit cell in units of a{asterisk} = 2.046 {angstrom}{sup {minus}1}. 8 refs., 3 figs.

7032 **(CEA-CONF—9458) Magnetic field dependence of static correlations and spin dynamics of reentrant spin glasses studied by neutron scattering.** Hennion, M.; Hennion, B.; Mirebeau, I.; Lequien, S.; Hippert, F. (Laboratoire Leon Brillouin, Centre d'Etudes de Saclay, 91 - Gif-sur-Yvette (FR); Paris-11 Univ., 91 - Orsay (FR)). (Laboratoire Leon Brillouin, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1988. 21p. (CONF-880705—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755606/JAW.

From International conference on magnetism; Paris, France (25 Jul 1988).

We report small angle (SANS) and inelastic neutron scattering in zero and applied field for a-FeMn, NiMn and AuFe at composition where both ferromagnetic and frustration characters occur. We discuss the field evolution of the transverse correlations which arise below T/sub c/. A study of the field sensitivity of the spin wave anomalies in a-FeMn is reported.

7033 **(CONF-880715—11) A neutron reflection test of the 'reptation time'.** Karim, A.; Mansour, A.; Felcher, G.P.; Russell, T.P. (Argonne National Lab., IL (USA); IBM Almaden Research Center, San Jose, CA (USA)). Jul 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01. Order Number DE89003637/JAW.

From 4. international conference on neutron scattering (ICNS '88); Grenoble, France (12 Jul 1988).

Two chemically similar polymers in contact at a temperature above the glass transition interdiffuse with a concentration profile which, for times shorter than a "reptation time," is thought to remain discontinuous at the interface. It is shown how the size of the concentration gap can be systematically tested by neutron reflection from bilayers of deuterated/protonated polymers. 6 refs., 2 figs.

7034 **(CONF-880812—26) Superconducting properties of magnetron sputtered high T/sub c/ thin films containing oxide compounds of yttrium, bismuth, or thallium.** Kang, J.H.; Kampwirth, R.T.; Gray, K.E. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003621/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

We have used multiple source magnetron sputtering to prepare thin films of Y-Ba-Cu-O, Bi-Ca-Sr-Cu-O, and Tl-Ca-Ba-Cu-O on (100) $SrTiO_3$, (100) MgO, and ZrO-9%Y_2O_3 substrates. Y-Ba-Cu-O films grow best on $SrTiO_3$ with mostly an a-axis orientation. Stoichiometry, particularly the Ba/Cu ratio must be within 2% of the correct value to obtain narrow ΔT/sub c/ transitions. Conversely, the 80K phase of Bi-Ca-Sr-Cu-O films grows best on MgO substrates and has a predominant c-axis orientation. The requirements on composition are less stringent, however, the annealing temperature must be held within a narrow range around 865{degree}C to obtain the best films. The best films of Tl-Ca-Ba-Cu-O compounds are grown on (100) oriented and polycrystalline ZrO_2 substrates. The highest transition temperature, T/sub c0/, where the resistance goes zero is about 114K in the $Tl_2Ba_2Ca_2Cu_3O$/sub x/ phase and 100--105K in $Tl_1Ba_2Ca_1Cu_2O$/sub x/ and $Tl_1Ba_2Ca_2Cu_3O$/sub x/ phase samples. The upper critical field measurements show high anisotropies in the critical field slopes (≥70 for Tl-Ba-Ca-Cu-O compounds and ~15 for Bi-Sr-Ca-Cu-O compounds), as might be expected from highly oriented materials. We will compare the preparation conditions and superconducting properties, including T/sub c/, ΔT/sub c/, dB/sub c2//dT (parallel and perpendicular to film surface), of all three compounds. 17 refs., 6 figs.

7035 **(CONF-880955—4) Inner-shell processes as probes of multicharged ion neutralization at surfaces.** Meyer, F.W.; Havener, C.C.; Overbury, S.H.; Reed, K.J.; Snowdon, K.J.; Zehner, D.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400;W-7405-ENG-48. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004166/JAW.

From International conference on the physics of multiply-charged ions; Grenoble, France (12 Sep 1988).

We have measured energy distributions for electrons emitted during grazing collisions of multicharged ions with Au and Cu single crystals in the projectile energy range 20--90 keV. The measured electron spectra are characterized by discrete peaks resulting from Auger transitions, superimposed on a broad continuum electron distribution. Auger electron emission from both projectile and target atoms has been observed. The projectile Auger electrons result from the decay of inner-shell vacancies either carried into the collision or produced by vacancy transfer from empty outer projectile levels via pseudocrossings or rotational coupling of molecular orbitals. The latter mechanism may also lead to the creation of target inner-shell vacancies which give rise to Auger electron emission characteristic of the target. An analysis of these Auger electron features is presented which is aimed, on the one hand, at elucidating detailed production mechanisms, and, on the other, at obtaining information on the time scales describing the neutralization of multicharged ions during their interaction with metal surfaces. 24 refs., 10 figs., 1 tab.

7036 **(EUR—11332) Remarks on the mathematical description of materials damage by irradiation.** Steinbach, E. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1987. 19p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755651/JAW.

In describing radiation damage processes in materials, the chemical rate theory proves to be the most effective mathematical method. The applicability, and even the validity, of this theory, which has been successfully applied in many other scientific fields, have been questioned by some authors. After rigorous mathematical analysis of the relevant rate equations and the corresponding self-consistent calculation of sink strengths, the main criticisms on this subject can be disproved.

7037 **(FRCEA-TH—108) Experimental study of mixed ferromagnetic spin glass systems.** Mirebeau, I. (Paris-11 Univ., 91 - Orsay (France)). 1987. 207p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88756142/JAW.

The mixed ferromagnetic spin glass systems are characterized by a distribution of positive and negative exchange interactions whose maximum occurs at a positive value. We have undertaken an experimental study of amorphous (Fe/sub 1-x/Mn/sub x/)/sub .75/ PBA1, polycrystalline and monocrystalline Ni/sub 1-x/Mn/sub x/ and Au/sub 1-x/Fe/sub x/ alloys. By Moessbauer effect, magnetization and neutron scattering, we show that below a "canting" temperature T/sub K/, spin components transverse to the mean magnetization become frozen. Small angle neutron scattering studies with an applied field show a magnetic "structure" i.e. the intensity exhibits a maximum at a finite q value for temperatures below T/sub K/. This structure has been studied as a function of temperature, applied field and concentration using both small angle neutron scattering and 3 axis spectrometry where we separate the elastic from the inelastic components. Possible interpretations of this new structure will be given.

7038 **(IFVE-OP—88-12) On some limitations in using coherent bremsstrahlung of electrons in single crystals at high energies.** Maisheev, V.A.; Mikhalev, V.L.; Frolov, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 16p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704959/JAW.

Coherent bremsstrahlung spectra of high energy electrons in single crystals (silicon) with account for multiple γ-quanta using classical relations have been calculated. the maximum electron energies for existing of such radiation have been also estimated. Limitations for using coherent bremsstrahlung for the production of polarized γ-quanta and relative increase of hard quanta intensity at high energies of electrons in physical experiments are discussed. 16 refs.; 5 figs.

7039 (INIS-SU—41, pp 38-41) **Anisotropy of spatial structure of primary radiation damagesproduced by ion channeling.** Gann, V.V.; Dyul'dya, S.V.; Yudin, O.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780008/JAW.

Voprosy atomnoj nauki i tekhniki.; no. 2(40).

In Radiation-induced damage physics and material technology. Scientific-technical collection.

Spatial structure of nickel monocrystal primary radiation-induced damage area, produced under 50 keV energy nickel ion destructive channelling in channel (100) is investigated by mathematical simulation method. It is shown that specific character of the channelled particle interaction with crystal lattice atoms leads to anisotropy occurrance in spatial distributions of radiation-induced defects. 3 refs.; 5 figs.

7040 (INIS-SU—43, pp 33-35) **Er/sup 3+/ ion new paramagnetic centers in Y/sub 3/Al/sub 5/O/sub 12/ crystals.** Bagdasarov, Kh.S.; Baranov, P.G.; Zhekov, V.I.; Murina, T.M.; Prokhorov, A.M.; Fedorov, E.A.; Khramtsov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

Using the ESPR method, new paramagnetic centres much different in their parameters from the well-known Er/sup 3+/ centres in Y/sub 3/Al/sub 5/O/sub 12/ crystals are found. 9 refs.; 2 figs.

7041 (INIS-SU—43, pp 53-55) **On possibility of unusual spin reorientation in orthoferrites.** Marchukov, P.Yu.; Rudashevskij, E.G. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

It is shown that in DyFeO/sub 3/-type antiferromagnetics unusual spin reorientation described by a phase diagram with a tetracritical point can be realized in a magnetic field. 5 refs.; 2 figs.

7042 (INIS-SU—43, pp 19-21) **Residual photoconductivity in far IR spectrum range for Pb/sub 0.78/Sn/sub 0.22/Te.** Voronova, I.D.; Semenova, E.V. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

No red boundary is observed for residual photoconductivity in Pb/sub 0.78/Sn/sub 0.22/Te:In up to {similar←to}350 μm wavelength. The character of temperature and time relaxation in the long-wave spectrum range is the same as in the shorter-wave one. An explanation of the phenomenon is proposed within the framework of the model of Jahn-Teller electron capture centres. 11 refs.; 3 figs.

7043 (INIS-SU—68, pp 256) **Circular polarized bremsstrahlung in partly disordered crystals.** Nadzhafov, I.M.; Radzhabov, M.R. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

7044 **(JAERI-M—88-161) Investigation on particle-solid interactions. Basic process relating to the plasma particle deposition profiles in solids, 2.** Yano, Syukuro. (Kobe Univ. of Mercantile Marine (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 69p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755527/JAW.

Basic processes in plasma-material interactions have been surveyed and reviewed. Problems concerned with carbon materials, which have been progressively used for the first wall and limiters in Tokamaks, are mainly discussed. Recent usage of carbon materials, basic properties and characteristics of carbon/graphite materials, desorption of gasses are described. As to the interactions of incident hydrogen isotope particles with graphite surface, data of trapping, depth profile, reemission, isotope exchange, and diffusion are reviewed and discussed.

6561 Superconductivity

REFER ALSO TO CITATION(S) 6187, 6189, 6191, 7034

7045 **(CONF-880626—1) Neutron irradiation of YBa{sub 2}Cu{sub 3}O{sub 7-{delta}}.** Weber, H.W.; Crabtree, G.W.; Umezawa, A.; Liu, J.Z.; Kwok, W.L.; Kwok, W.K. (Argonne National Lab., IL (USA)). Jun 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003946/JAW.

From International conference on electronic materials; Tokyo, Japan (12 Jun 1988).

Critical magnetization currents were measured in single crystalline YBa{sub 2}Cu{sub 3}O{sub 7{minus}{delta}}, with the field parallel and perpendicular to the c-axis, as a function of neutron fluence. Up to fluences of {approximately} 8 {times} 10{sup 21} m{sup {minus}2} (E > 0.1 MeV) we observe a linear decrease of transition temperatures with a slope of {minus}2.6 K per 10{sup 22} neutrons m{sup {minus}2}. In general, the critical magnetization currents are enhanced significantly at all temperatures. However, because this enhancement is always more pronounced if the field is applied in the a- or b-directions, the intrinsic anisotropy of critical current densities is drastically decreased by the irradiation, e.g., from 44 to 9 at 5 K and 1 T. Both the enhancement factors and the anisotropy show interesting temperature dependences, which will require more detailed investigation. 11 refs., 3 figs., 1 tab.

7046 **(CONF-880812—25) Experimental study of flux pinning in NbN films and multilayers: Ultimate limits on critical currents in superconductors.** Gray, K.E.; Kampwirth, R.T.; Capone, D.W. II; Murduck, J.M. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003622/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

A flux pinning model is presented which predicts the maximum critical current density attainable in superconductors. That such a limit must exist comes from the realization that flux pinning is strongest in regions of weak superconductivity, but these regions cannot carry a large supercurrent. Since the same regions within the superconductor cannot be used for both pinning and supercurrent conductions, there must be an optimum mix, leading to a maximum J{sub c}. Measurements on films and multilayers of NbN have verified many details of the model including anisotropy effects and a strong reduction in J{sub c} for defect spacings smaller than the flux core diameter. In an optimized multilayer the pinning force reached {approximately}22% of the theoretical maximum. The implications of these results on the practical applications of NbN films and on the maximum critical current density in the new high temperature superconductors are also discussed. 24 refs., 4 figs.

7047 **(CONF-881079—1) Magnetic shielding effectiveness of superconductors.** Pienkowski, T.; Kincaid, J.; Lanagan, M.T.; Poeppel, R.B.; Balachandran, U.; Shi, Donglu; Goretta, K.C. (Argonne National Lab., IL (USA); Belden Wire and Cable, Geneva, IL (USA)). 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003651/JAW.

From Superconductivity '88; Boston, MA, USA (19 Oct 1988).

Superconductors have been considered for electromagnetic shields in large systems which can justify the expense of cooling with liquid helium. The advent of higher critical temperature superconductors has allowed investigations into their possible implementations in smaller systems which can only justify the cost of less expensive liquid nitrogen. This new type of superconductor is quite brittle and mechanically difficult to handle. One solution to this obstacle might be to mix superconductive powder in a plastic matrix. This paper presents the results of a preliminary investigation into the magnetic shielding effectiveness of the YBa_2Cu_3O/sub 7-x/ superconductors both mixed in a plastic matrix and as a pure ceramic. However, before the discussion of superconductive shielding, a short review of a couple of traditional shielding concepts might be appropriate. 8 refs., 3 figs.

7048 **(DOE/ER/45195—2) Photoemission studies of f-electron systems: Many-body effects: Final report, March 1, 1985--March 31, 1988.** Horn, S. (New York Univ., NY (USA). Dept. of Physics). Jun 1988. Contract FG02-85ER45195. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89004106/JAW.

Both initial and final state effects contribute to many-body features in photoemission on solids. The former reflect the ground state properties of the system, while the latter are due to the reaction of the solid state environment to the creation of a photoelectron hole. In f-electron systems both effects are expected to contribute to the photoemission spectra and one objective of this project was to separate final state effects from ground state properties. Final state effects provide valuable information about the interaction of f electrons with conduction electrons. The degree of f-electron localization and the strength of f-conduction electron hybridization for Ce- and U-based systems can be extracted from these measurements. The energy dependence of the photoemission cross section, which shows pronounced maxima in rare earth and uranium systems, also proved to be sensitive to the exact electronic state of the Ce ion. Core level photoemission spectroscopy was used as a species-specific probe to determine the electronic state of the f-shell ions and their ligands in scientific interesting systems. Application to high temperature superconducting compounds helped to determine the electronic properties necessary for superconductivity.

7049 **(IAE—4582/10) Superconductivity mechanism in metal oxides with variable valency.** Ivanov, S.P.; Manakova, L.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1988. 61p. (In Russian). NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS. Order Number DE88704953/JAW.

In the present paper it is shown, that the metals with the mixed valency can have the subsystem of the local electron pairs. The local pairs may appreciably change the optical elastic modulus and the lattice parameters. The additions to the elastic modulus and the lattice parameters depend on concentration of the local pairs and temperature. The peculiarity of these dependences is the extrema. The concentration and temperature dependences of the additions are determined by intercentre correlations and pair delocalisation (pair transfer) in the subsystem of the local pairs. These results were used for the construction of the high-temperature superconductivity mechanism for the metals with the mixed valency. 50 refs.; 13 figs.

7050 **(INIS-SU—51, pp 31-32) Variation of critical current in YBa/sub 2/Cu/sub 3/O/sub 7-x/ in weak magnetic fields.** Golovashkin, A.I.; Golyamina, E.M.; Lykov, A.N.; Mukhachev, V.B. 1987. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88780180/JAW.

Kratkie Soobshcheniya po Fizike.; (no.12).

In Quantum radiophysics. Collection.

Critical current density and Volt-Ampere characteristics are measured for high-temperature YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductors at nitrogen temperatures in weak magnetic fields. The results are explained on the basis of Josephson interaction between separate superconducting microcrystals. 4 refs.; 2 figs.

7051 **(IS-M—608) Incongruent melting of the high temperature superconductor YBa{sub 2}Cu{sub 3}O{sub 7}.** McCallum, R.W.; Noack, M.A.; Verhoeven, J.D.; Gibson, E.D.; Ku, H.C. (Ames Lab., IA (USA)). 1987. Contract W-7405-ENG-82. 2p. (CONF-870873—31). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003734/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

A study has been made of the melting of the high temperature superconductor YBa{sub 2}Cu{sub 3}O{sub 7}. The material was found to melt at 980{degree}C in an atmosphere of argon 20% oxygen. In a commercial oxygen atmosphere the melting temperature was found to increase by approximately 20{degree}C. Above the melting point the material consisted of a molten phase of BaCuO{sub 2}-Cu{sub 2}O-CuO and solid Y{sub 2}BaCuO{sub 7}. Subsequent heat treating at 940{degree}C restores the superconducting phase. 5 refs., 2 figs.

7052 **(IS-M—609) Effect of transition-metal substitution for Fe in superconducting Lu{sub 2}Fe{sub 3}Si{sub 5}.** Xu, Y.; Shelton, R.N. (Ames Lab., IA (USA)). 1987. Contract W-7405-ENG-82. 2p. (CONF-870873—30). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003735/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

The effect of transition-metal substitution for Fe on the superconducting transition temperature, T{sub c}, of compounds Lu{sub 2}(Fe{sub 1-x}T{sub x}){sub 3}Si{sub 5}, where T = Cr, Mn, Co, Ni, Ru, is reported. In every instance, T{sub c} of the host compound Lu{sub 2}Fe{sub 3}Si{sub 5} (T{sub c} = 6.11 K) is reduced by the addition of other transition metals. An analysis of the data within the framework of the theory due to Kaiser suggests the depression of T{sub c} is due to the formation of a nonmagnetic resonance state. 10 refs., 2 figs.

7053 **(IS-M—610) Anisotropy effects upon the magnetic properties of High-T/sub c/ superconductors.** Kogan, V.G.; Clem, J.R. (Ames Lab., IA (USA)). 1987. Contract W-7405-ENG-82. 2p. (CONF-870873—29). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003736/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

All known high-T/sub c/ superconductors are strongly anisotropic. We use the mass tensor formulation of the Ginzburg-Landau theory to discuss the effects of anisotropy upon various magnetic properties of single- and polycrystals. We also consider the influence of anisotropy upon the width of the resistive transition as a function of field. 11 refs., 1 fig.

7054 **(IS-M—611) Theory of the magnetization of granular superconductors: Application to high-T/sub c/ superconductors.** Clem, J.R.; Kogan, V.G. (Ames Lab., IA (USA)). 1987. Contract W-7405-ENG-82. 3p. (CONF-870873—28). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003737/JAW.

From 18. conference on low temperature physics; Kyoto, Japan (20 Aug 1987).

We calculate the dc magnetization of a three-dimensional array of weakly Josephson-coupled superconducting grains whose dimensions are of the order of the intragranular weak-field penetration depth. Because of significant flux penetration into small grains, the initial slope of the magnetization versus applied field not only is smaller than that for very large grains of the same shape, but also decreases with increasing temperature and vanishes at the critical temperature. The same behavior is expected for the ac susceptibility versus increasing temperature in a sample cooled in zero field. The dc magnetization is found to exhibit a corresponding size-dependent suppression for all fields up to the upper critical field. 15 refs., 1 fig.

7055 **(IS-M—615) Evidence for spin fluctuations in the mixed valent superconductors Ce(Ru/sub 1-x/Os/sub x/)$_3$B$_2$.** Athreya, K.S.; Shelton, R.N. (Ames Lab., IA (USA)). 1987. Contract W-7405-ENG-82. 7p. (CONF-870142—16). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003741/JAW.

From 5. international conference on valence fluctuations; Bangalore, India (5 Jan 1987).

Compounds containing cerium span a remarkably diverse range of electronic and magnetic properties. Among cerium based compounds are semiconductors, re-entrant superconductors, mixed valent and Kondo systems, superconducting and non-superconducting heavy fermion systems, and system exhibiting anomalous ferromagnetism. The hexagonal (P6/mmm) compound $CeRu_3B_2$ and the iso-electronic $CeOs_3B_2$ are known to be superconducting with transition temperatures of 1.1 K and 3.5 K, respectively. Bulk nature of the superconductivity in these compounds has been confirmed by specific heat measurements. Static susceptibility measurements indicate strong mixed valence of cerium in these compounds. In this paper we present data from an investigation of the variation of the superconducting transition temperature (T/sub c/) with Os concentration in the pseudoternary series Ce(Ru/sub 1-x/Os/sub x/)$_3$B$_2$, as well as results of static susceptibility and dc electrical resistivity measurements across the series. 9 refs., 3 figs., 2 tabs.

7056 **(IS-M—616) Pressure effects on high T/sub c/ superconducting oxides with the K_2NiF_4-type structure.** Shelton, R.N.; Folkerts, T.J.; Klavins, P.; Ku, H.C. (Ames Lab., IA (USA)). [1987]. Contract W-7405-ENG-82. 4p. (CONF-870438—40). NTIS, PC A02/MF A01. Order Number DE89003742/JAW.

From Spring meeting of the Materials Research Society; Anaheim, CA, USA (21 Apr 1987).

In this study, we investigate the superconducting properties under hydrostatic pressure of three high T/sub c/ oxides with the composition (La/sub 1.85/M/sub 0.15/)CuO_4, where M = Ca, Sr, Ba. These materials, which crystallize in the K_2NiF_4-type body-centered tetragonal structure (I4/mmm) or a related orthorhombic modification (Fmmm), have been the focus of intense experimental and theoretical research since the initial report of superconductivity above 30 K in a multiphase sample of these ternary oxides. The effect of high pressure on T/sub c/ has been an important factor in the investigation of the occurrence of superconductivity in ternary compounds. With few exceptions, pressure effects on the elements and binary compounds are nearly linear and small (usually {vert←bar}dT/sub c//dp{vert←bar} {approximately} 10/sup {minus}5/ K/bar). In contrast, there are numerous ternary superconductors that exhibit pronounced non-linearities in T/sub c/ versus pressure with values of dT/sub c//dp an order of magnitude higher than normally observed. There has been prior reference to a large pressure sensitivity of T/sub c/ for some compounds with this structure. 17 refs.

7057 **Pairing-bag excitations in small-coherence-length superconductors.** Bishop, A.R.; Lomdahl, P.S.; Schrieffer, J.R.; Trugman, S.A. (Theoretical Division and Advanced Studies Program in High Temperature Superconductivity Theory, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **61**: No. 23, 2709-2712(5 Dec 1988).

Localized baglike solutions in the pairing theory of superconductivity are studied. Starting from the Bogoliubov–de Gennes equations on a two-dimensional square lattice for half-filled negative-U Hubbard model, cigar- and star-shaped bags are numerically obtained, inside of which the order parameter is reduced, self-consistently trapping an added quasiparticle. These nonlinear excitations are important when the coherence length is small as for the new high-temperature superconductors. Several experimental consequences are discussed.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 6543, 6545, 6682

7058 **(BNL—41851) Scale invariant spacial and temporal fluctuations in complex systems.** Bak, P.; Tang, Chao; Wiesenfeld, K. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-8807132—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89002904/JAW.

From NATO ASI meeting on fluctuations and pattern formation; Corse, France (18 Jul 1988).

Dynamical systems with many degrees of freedom can evolve (or be driven) into a stationary state exhibiting scale invariant special and/or temporal fluctuations. General arguments are supported by numerical simulations of simple models. Scaling exponents are defined and calculated. We suggest that the concept presented here has wide potential applications, including fractal patterns, 1/f noises, randomly pinned surfaces or interfaces, glasses, and transition to turbulence. Some of the applications are discussed in detail. 6 refs., 3 figs.

7059 **(CONF-880758—5) Relativistic models in nuclear and particle physics.** Coester, F. (Argonne National Lab., IL (USA). Physics Div.). 1988. Contract W-31109-ENG-38. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003644/JAW.

From Workshop on nuclear and particle physics on the light cone; Los Alamos, NM, USA (18 Jul 1988).

A comparative overview is presented of different approaches to the construction of phenomenological dynamical models that respect basic principles of quantum theory and relativity. Wave functions defined as matrix elements of products of field operators on one hand and wave functions that are defined as representatives of state vectors in model Hilbert spaces are related differently to observables and dynamical models for these wave functions have each distinct advantages and disadvantages 34 refs.

7060 **(CONF-8809191—1) Global existence for symmetric discrete velocity models.** Protopopescu, V. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003102/JAW.

From Workshop on discrete models lattice gas dynamics and foundations of hydrodynamics; Torino, Italy (19 Sep 1988).

For symmetric discrete velocity models, some generalizations of previous global existence proofs are given to include bounded geometries, continuous models, and stationary states with no momentum conservation. Additional results and simpler proofs are obtained for completely symmetric models. 12 refs.

7061 **(EUR-CEA-FC—1350) Study of the change of variable sin(π k/sub 0/ δ) = sn (4 K u).** Mercier, C. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jul 1988. 14p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756127/JAW.

In the study of magnetic islands, the change of variable sin(π K/sub 0/ δ) = sn (4 K u) is introduced. If U = O, δ = O. The coefficients of the Fourier expansion of the change of variable δ -> u are investigated.

7062 **(GANIL-P—88-08) Strongly enhanced flow effect from Landau-Vlasov versus Vlasov-Uehling-Uhlenbeck approach.** Gregoire, C.; Remaud, B.; Sebille,; Schuck, P.; Suraud, E. (Nantes Univ., 44 (France); Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Rijksuniversiteit Groningen (NL)). (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756156/JAW.

The simulation of the collision integral in the Landau-Vlasov approach for heavy ion collisions is examined. It turns out that quantities like the nucleon mean free path can be compared with parallel ensemble models. Convergency of results with time step and sampling is clearly established. Quadratic quantities, like the internal pressure, are found to be strongly underestimated in parallel ensemble models.

7063 (INIS-SU—68, pp 432) **On breaking of three-particle unitarity in the Lovelace equations.** Takibaev, N.Zh. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

7064 (INIS-SU—68, pp 434) **Similarity of one-parameter problems of charged particle scattering theory.** Popushoj, M.N. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

7065 (INIS-SU—68, pp 436) **Dispersion relation for scattering amplitude in the presence of absorption potential.** Kashuba, I.E.; Ol'khovskij, V.S. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

7066 (JINR—D-2-87-123, pp 233-247) **Dynamical and spectral properties of interacting quantum nonlinear resonances.** Berman, G.P.; Vlasova, O.F.; Kolovskij, A.R.; Izrajlev, F.M. (AN SSSR, Krasnoyarsk. Inst. Fiziki; AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

While considering nonlinear quantum systems in the quasiclassical occupation region interacting with an external periodical field, the renormalization method is used. In case of interactions of two nonlinear resonances renormalization is associated with occurence of higher order nonlinear resonances. There is a limit in the renormalization pattern related to existence of higher resonances, for which the number of quasienergy levels in the potential pit is small. Analysis of distributions of delocalized quasi-energy functions, corresponding to destroyed resonances, and those of distances between the adjastment quasienergy levels has shown the presence of considerable correlations. The correlations are due to phase space restricted in action and quantum effects leading to classical chaos restriction. 22 refs.; 7 figs.

7067 **(JINR—D-2-87-123) Conference renormalization group-86.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. 417p. (In Russian). (CONF-8608234—). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW.

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

Each paper in these proceedings has been abstracted and indexed.

7068 **(JINR-R—2-88-132) Born-Infeld equations and minimal surfaces.** Shavokhina, N.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1988. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704966/JAW.

Submitted to the journal Izvestiya vuzov. Matematika.

In the N-dimensional flat space (N ≧ 3) with symmetric nondegenerated metric of any index the systems are under consideration: a) the system of Born - Infelds equations and b) the system of equations defining K-dimensional surfaces in this space (1 ≦K≧N-1). It is explicitly demonstrated that there exist solutions common for the considered systems and the possibility of these solutions follows from the variational principle. 3 refs.

7069 **(JINR-R—5-88-119) Feynman formula for systems of partial differential equations with constant or rapidly decreasing coefficients.** Ktitarev, D.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1988. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704967/JAW.

Submitted to the journal Differentsial'nye uravneniya.

The Cauchy problem for the system of linear pseudodifferential equations is considered. For two classes of such systems including partial differential systems with conbstant and rapidity decreasing variable coefficients a solution by series is obtained. The series is represented in the form of feynman integral in phase space of chronological exponent of operator-valued symbol of pseudodifferential operator. 10 refs.

7070 **(SLAC-PUB—4528-Rev.) An essay on discrete foundations for physics.** Noyes, H.P.; McGoveran, D.O. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). 5 Oct 1988. Contract AC03-76SF00515. 48p. (CONF-8709318—4-Rev.). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004608/JAW.

From 9. annual international meeting of the Alternative Natural Philosophy Association; Cambridge, UK (23 Sep 1987).

We base our theory of physics and cosmology on the five principles of finiteness, discreteness, finite computability, absolute non- uniqueness, and strict construction. Our modeling methodology starts from the current practice of physics, constructs a self-consistent representation based on the ordering operator calculus and provides rules of correspondence that allow us to test the theory by experiment. We use program universe to construct a growing collection of bit strings whose initial portions (labels) provide the quantum numbers that are conserved in the events defined by the construction. The labels are followed by content strings which are used to construct event-based finite and discrete coordinates. On general grounds such a theory has a limiting velocity, and positions and velocities do not commute. We therefore reconcile quantum mechanics with relativity at an appropriately fundamental stage in the construction. We show that events in different coordinate systems are connected by the appropriate finite and discrete version of the Lorentz transformation, that 3-momentum is conserved in events, and that this conservation law is the same as the requirement that different paths can "interfere" only when they differ by an integral number of deBroglie wavelengths. 38 refs., 12 figs., 3 tabs.

7071 **(UCRL—21117) Passive localization: A model-based approach.** Candy, J.V.; Sullivan, E.J. (Lawrence Livermore National Lab., CA (USA)). May 1988. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003514/JAW.

Passive localization by use of propagation models, sometimes called 'Matched Field Processing' is usually carried out in three steps. First some appropriate model is selected, then model parameters (usually taken from archival data or from auxiliary measurements) are introduced into the model. Finally acoustic measurements of the field radiated by the source to be located are made---which, in combination with the properly parameterized model, allow a solution for the source coordinates to be carried out. Here we use such a model-based approach in conjunction with a normal-mode model. By coupling the procedure with a parameter estimation/identification scheme and using a horizontal (towed) array instead of the usual vertical array, we show that the model parameters need not be known a priori in order to carry out the solution. This is in contrast to the standard approach in which the modal functions and wavenumber must be a priori known in order to solve the problem; sufficient information to determine the range of the source can be inferred directly from the measured data themselves. Using a sophisticated acoustic propagation model to generate simulated data, coupled with various array processing techniques, the feasibility of the approach is demonstrated. The essential problems associated with the technique are found to be the need for a large aperture for sufficiently accurate wavenumber estimation, and the need for a general sensitivity study in order to evaluate the efficiency of the algorithm. 16 refs., 11 figs., 1 tab.

7072 **(USGS-OFR—88-242) Preliminary results of absolute and high-precision gravity measurements at the Nevada Test Site and vicinity, Nevada.** Zumberge, M.A.; Harris, R.N.; Oliver, H.W.; Sasagawa, G.S.; Ponce, D.A. (Geological Survey, Menlo Park, CA (USA)). 1988. Contract AI08-78ET44802. 31p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003459/JAW.

Absolute gravity measurements were made at 4 sites in southern Nevada using the absolute gravity free-fall apparatus. Three of the sites are located on the Nevada Test Site at Mercury, Yucca Pass, and in northern Jackass Flats. The fourth site is at Kyle Canyon ranger station near Charleston Park where observed gravity is 216.19 mGal lower than at Mercury. Although there is an uncertainty of about 0.02 mGal in the absolute measured values, their gravity differences are considered accurate to about 0.03 mGal. Therefore, the absolute measurements should provide local control for the calibration of gravity meters between Mercury and Kyle Canyon ranger station to about 1 to 2 parts in 10,000. The average gravity differences between Mercury and Kyle Canyon obtained using LaCoste and Romberg gravity meters is 216.13 mGal, 0.06 mGal lower, or 3 parts in 10,000 lower than using the absolute gravity meter. Because of the discrepancy between the comparison of the absolute and relative gravity meters, more absolute and relative gravity control in southern Nevada, as well as the Mt. Hamilton area where the LaCoste and Romberg instruments were calibrated, is needed. Multiple gravity meter ties were also made between each of the four absolute stations to nearby base stations located on bedrock. These stations were established to help monitor possible real changes in gravity at the absolute sites that could result from seasonal variations in the depth to the water table or other local mass changes. 8 refs., 16 figs., 7 tabs.

7073 **Reply to "Comment on 'Small-signal analysis in high-energy physics: A Bayesian approach' ".** Prosper, H.B. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **38**: No. 11, 3584-3585(1 Dec 1988).

Williams argues for a broader interpretation of the postulate about prior probabilities presented in a recent paper [H. B. Prosper, Phys. Rev. D 37, 1153 (1988)]. I argue that the interpretation of invariance used in that paper is the only reasonable interpretation if one accepts, as I do, Jaynes's basic desideratum about prior probabilities.

7074 **Signal attenuation due to cavity leakage.** Sherman, M.H.; Modera, M.P. (Energy Performance of Buildings Group, Applied Science Division, Building 90, Room 3074, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of the Acoustical Society of America;* **84**: No. 6, 2163-2169(Dec 1988).

The propagation of sound waves in fluids requires information about three properties of the system: capacitance (compressibility), resistance (friction), and inductance (inertia). Acoustical design techniques to date have tended to ignore the frictional effects associated with airflow across the envelope of the acoustic cavity (e.g., resistive vents). Since such leakage through the cavity envelope is best expressed with a power law dependence on the pressure, standard Fourier techniques that rely on linearity cannot be used. In this article, the theory relevant to nonlinear leakage is developed and equations presented. Potential applications of the theory to techniques for quantifying the leakage of buildings are presented. Experimental results from pressure decays in a full-scale test structure are presented and the leakage so measured is compared with independent measurements to demonstrate the technique.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 7112, 7112, 7117, 7118

7075 **(DOE/ER/13787—8) New experimental results in muon-catalyzed fusion.** Jones, S.E. (Brigham Young Univ., Provo, UT (USA). Dept. of Physics and Astronomy). 1988. Contract FG02-87ER13787. 9p. (IAEA-CN—50/H-I-6; CONF-881015—31). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004059/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Muons introduced into relatively cold, dense deuterium-tritium mixtures quickly form muonic d-t molecules in which d-t fusion takes place very rapidly. Yields of up to 150 catalyzed fusions per muon have been achieved, renewing interest in muon-catalyzed fusion as a possible source of energy. 10 refs., 4 figs.

7076 **(DOE/ET/53017—85) Field-reversing electron and ion rings for the confinement and heating of plasmas: Annual progress report, October 1, 1987--September 30, 1988.** Fleischmann, H.H. (Cornell Univ., Ithaca, NY (USA)). Oct 1988. Contract AC02-76ET53017. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003811/JAW.

Due to the sizable reduction in funding and related reductions in personnel, our work effort during this report period was sizably reduced from our earlier level. In view of this situation our effort was concentrated mainly on efforts to improve our diode performance, the conversion of our pulse driver to a pulse line using water as insulator (about 1 MV, 2 Ohm, 200 nsec) which is nearly completed, first calculations of single particle orbits needed for the analysis of future ion beam/ring experiments, the completion of calculations on drift orbits in spheromak fields and some improvements of our diagnostic capability.

7077 **(DOE/ET/53088—353) Numerical investigation of a plasma beam entering transverse magnetic fields.** Koga, J.; Geary, J.L.; Tajima, T.; Rostoker, N. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Nov 1988. Contract FG05-80ET53088. 34p. (IFSR—353). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003829/JAW.

We study plasma beam injection into transverse magnetic fields using both electrostatic and electromagnetic particle-in-cell (PIC) codes. In the case of small beam momentum or energy (low drift kinetic {beta}) we study both large and small ion gyroradius beams. Large ion gyroradius beams with a large dielectric constant {epsilon} {much←gt} (M/m){sup {1/2}} are found to propagate across the magnetic field via E {times} B drifts at nearly the initial injection velocity, where {epsilon} = 1 + ({omega}{sup pi}{sup 2})/({Omega}{sub i}{sup 2}) and (M/m) is the ion to electron mass ratio. Beam degradation and undulations are observed in agreement with previous experimental and analytical results. When {epsilon} is on the order of (M/m){sup {1/2}}, the plasma beam propagates across field lines at only half its initial velocity and loses its coherent structure. When {epsilon} is much less than (M/m){sup {1/2}}, the beam particles decouple at the magnetic field boundary, scattering the electrons and slightly deflecting the ions. For small ion gyroradius beam injection a flute type instability is observed at the beam magnetic fields interface. In the case of large beam momen-

tum or energy (high drift kinetic {beta}) we observe good penetration of a plasma beam which shields the magnetic field from the interior of the beam (diagmagnetism). 25 refs., 13 figs., 1 tab.

7078 **(DOE/FTR—9003563) [Joint research as an exchange scientist under the Joint Institute for Fusion Theory Cooperative Program, Japan, March 25--June 9, 1988]: Foreign trip report.** Matsuda, Yoshiyuki. (Lawrence Livermore National Lab., CA (USA)). 8 Jul 1988. Contract W-7405-ENG-48. 19p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003563/JAW.

During March 31 through June 1, the traveler visited the Institute for Fusion Theory at Hiroshima University in Japan to participate in a joint research as an exchange scientist under the Joint Institute for Fusion Theory Cooperative Program. The research topic was a particle simulation of Alfven wave instability in a neutral-beam current-driven system. His collaborators were Profs. T. Sato and M. Tanaka. Preliminary results were encouraging enough for them to agree to continue the joint research through a computer linkage between MFECC and IPP, Nagoya. His trip began on March 25 and ended on June 9, 1988.

7079 **(ENEA-RT-TIB—88-5) Jetto a free boundary plasma transport code. Basic version.** Cenacchi, G.; Taroni, A. (ENEA, Bologna (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 84p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704436/JAW.

JETTO is a one-and-a-half-dimensional transport code calculating the evolution of plasma parameters in a time dependent axisymmetric MHD equilibrium configuration. A splitting technique gives a consistent solution of coupled equilibrium and transport equations. The plasma boundary is free and defined either by its contact with a limiter (wall) or by a separatrix or by the toroidal magnetic flux. The Grad's approach to the equilibrium problem with adiabatic (or similar) constraints is adopted. This method consists of iterating by alternately solving the Grad-Schluter-Shafranov equation (PDE) and the ODE obtained by averaging the PDE over the magnetic surfaces. The bidimensional equation of the poloidal flux is solved by a finite difference scheme, whereas a Runge-Kutta method is chosen for the averaged equilibrium equation. The 1D transport equations (averaged over the magnetic surfaces) for the electron and ion densities and energies and for the rotational transform are written in terms of a coordinate (rho) related to the toroidal flux. Impurity transport is also considered, under the hypothesis of coronal equilibrium. The transport equations are solved by an implicit scheme in time and by a finite difference scheme in space. The centering of the source terms and transport coefficients is performed using a Predictor-Corrector scheme. The basic version of the code is described here in detail; input and output parameters are also listed.

7080 **(EUR-CEA-FC—1338) Estimation of volt second saving by application of lower hybrid waves on JET.** Van Houtte, D. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Dec 1987. 79p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756120/JAW.

Volt-second saving by application of lower hybrid current discharges on JET is assessed and the extent of the duration time of the flat top current is estimated. A data base obtained mainly on PETULA is compared with theory. Together with an optimization of LH and plasma parameters, a hybrid (OH-LH) current drive operating scenario for volt-second saving is proposed for JET. An RF-assisted ohmic heating current rises up on JET enables volt-second to be saved enough to achieve a longer plasma current flat top than could be achieved by ohmic heating alone. This plasma current, up to I/sub p/ = 7MA, should last as long as the toroidal and equilibrium field allows it.

7081 **(EUR-CEA-FC—1341) Electron cyclotron resonance heating experiments on TFR. TFR-group and FOM-ECRH team.** (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Mar 1988. 65p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756121/JAW.

A joint Euratom-CEA, Euratom-FOM ECRH program was conducted on the TFR tokamak during 1985 and 1986, with 600 KW of ECR power at 60 GHz. This paper describes the experiments done during this period, and analyses the results. The topics addressed were: heating and transport, MHD stabilisation, suprathermics and current drive, pellet ablation during ECRH.

7082 **(EUR-CEA-FC—1343) Wave damping and current drive efficiency in synchrotron radiation.** Granata, G.; Fidone, I.; Meyer, R.L. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee; Nancy-1 Univ., 54 (France)). (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Apr 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756122/JAW.

The current drive efficiency for $\omega > 3$ ω/sub c/ is computed and the results are compared with the asymptotic formula obtained for ω/ω/sub c/ $>> 1$. The corresponding wave absorption coefficient is also investigated for arbitrary direction of propagation.

7083 **(EUR-CEA-FC—1344) Selective electron-cyclotron wave absorption for remote control of the current density profile in Tore Supra.** Giruzzi, G.; Fidone, I.; Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance; Dept. de Recherches sur la Fusion Controlee). (Associatie Euratom-FOM, Nieuwegein (NL). FOM-Institut voor Plasmafysica; France). (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). May 1988. 62p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756123/JAW.

Electron-cyclotron wave absorption by the current-carrying electron tail generated during lower-hybrid current drive in Tore Supra is investigated. The tail structure is determined by means of a 3-D bounce-averaged Fokker-Planck code and the electron-cyclotron wave power deposition is evaluated along the ray trajectories determined by a ray-tracing code. It is shown that efficient control of the power deposition both in real and in momentum space can be achieved by varying the launching angles. Wave emission and transmission at the harmonics of the electron gyrofrequency is also investigated. The potential of this diagnostic of the electron tail before and during electron-cyclotron heating of the lower-hybrid tail is discussed.

7084 **(EUR-CEA-FC—1351) Soft X-ray emission during application of lower hybrid waves on JET.** Peysson, Y.; Hesse, M. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Apr 1988. 62p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756128/JAW.

In this report, we study the local variation of the integrated X-ray emission between various photon energy ranges corresponding to a Si(Li) diode, when fast electrons are induced by lower hybrid waves. Carbon, oxygen, iron and nickel impurities are considered. The modification of the charge equilibrium of the plasma by fast electrons within the corona model is investigated, and the consequences on the radiated power discussed. Corrections due to multi-ionization and impurity transport are evaluated. The difference of the emitted X-ray power per ion between a maxwellian and a suprathermal distribution can yield also to a significant variation of the integrated X-ray emission. This effect is evaluated for various situations of suprathermal distributions and electronic temperatures. Some simple accomodations of existing diagnostic in JET are then proposed, in order to diagnose the fast electron tail.

7085 (EUR-CEA-FC—1352) Representation of MHD and its application to nonlinear stationary states. Morros Tosas, J.; Maschke, E.K. (Association Euratom-CEA, Centre d'Études Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee). Jul 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756129/JAW.

In order to study nonlinear saturated MHD instabilities, a previously proposed exact representation of MHD by scalar functions is generalized to arbitrary non-orthogonal coordinates, and a system of reduced equations is derived for the case of helical symmetry. Using this reduced system, the bifurcation of stationary nonlinear solutions of the kink type from a cylindrical plasma equilibrium is studied.

7086 (FRNC-TH—3342) Mathematical and numerical analysis of plasma stability. Saramito, B. (Paris-6 Univ., 75 (France)). Nov 1987. 557p. (In French). NTIS (US Sales Only), PC A24/MF A01. Order Number DE88756146/JAW.

Equilibrium of a tokamak plasma is analyzed using two two-dimensional numerical models. Plasma configuration; convection in a cylindrical plasma layer; and tearing instabilities in a flat layer are considered. The finite element code used is explained. The existence of analogous stationary solutions for a problem concerning compressible fluids is shown. Stationary convection created by the equilibrium density gradient is treated. Approximation using fluid equations is employed in the case of convection resulting from the equilibrium temperature gradient. Evolution towards turbulence of incompressible fluid models is followed.

7087 (FRNC-TH—3343) Identification and optimization problems in plasma physics. Gilbert, J.C. (Paris-6 Univ., 75 (France)). Jun 1986. 266p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88756147/JAW.

Parameter identification of the current in a tokamak plasma is studied. Plasma equilibrium in a vacuum container with a diaphragm is analyzed. A variable metric method with reduced optimization with nonlinear equality constraints; and a quasi-Newton reduced optimization method with constraints giving priority to restoration are presented.

7088 (GA-A—19291) Modification of the scrape-off layer by edge plasma modes. Mahdavi, M.A.; Hill, D.; Allen, S.; Brooks, N.; Burrell, K.H.; Carlstrom, T.; Content, D.; DeBoo, J.; Gohil, P.; Gottardi, N. (General Atomics Co., San Diego, CA (USA)). Sep 1988. Contract AC03-84ER51044. 18p. (CONF-880512—15). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003136/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

The improved energy confinement of the H-mode is invariably coupled to improved particle confinement. In other experiments, increased particle confinement resulted in impurity accumulation and severe power losses. In DIII-D, similar to the results of other experiments, H-mode confinement is associated with improved particle confinement. But in contrast to other devices, in most DIII-D H-mode plasmas there is no indication of impurity accumulation. In high current shots the impurity content of the plasma during the H-mode is lower than the L-mode phase. Two factors most responsible for the low impurity content of DIII-D H-mode plasmas are the nearly flat or hollow electron density profiles and the presence of giant Edge Localized Modes (ELMs). Giant ELMs also cause large amplitude modulations in particle and power flow to the divertor target plates, resulting in large-scale changes in the parameters of the scrape-off layer plasma. Our analysis of temperature and density profiles during ELMs show that particle loss during ELMs is primarily due to perpendicular transport across the field lines. 10 refs., 6 figs.

7089 (GA-A—19297) Resonant helical divertor experiments in ohmic and auxiliary heated JIPP T-IIU plasmas. Evans, T.E.; deGrassie, J.S.; Garner, H.R.; Leonard, A.W.; Ohyabu, N.; Peranich, L.S.; Mohri, A.; Hamada, Y.; Ida, K.; Kaneko, O.; Kawahata, K.; Kitagawa, S.; Kuroda, T.; Masai, K.; Morita, S.; Ogawa, Y.; Okamura, S.; Sata, K.N.; Sakamoto, M.; Yamada, H.; Yamazaki, K.; Watari, T.; Karger, F. (General Atomics Co., San Diego, CA (USA); Nagoya Univ. (Japan). Inst. of Plasma Physics; Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1988. Contract AC03-84ER51044. 21p. (CONF-880512—16). NTIS, PC A03/MF A01 - OSTI. Order Number DE88016519/JAW.

From 8. international conference on plasma surface interactions in controlled fusion devices; Julich, F.R. Germany (2 May 1988).

A series of initial resonant helical divertor (RHD) experiments have been carried out in ohmically and auxiliary heated JIPP T-IIU plasmas. Disruptive and MHD instabilities make the interpretation of the RHD results difficult but an apparent increase in the energy confinement time is observed when the helical magnetic perturbation is applied. This may be due to the suppression of MHD activity or to a reduction in the edge convective heat losses. Magnetic island effects have been observed on the floating potential of a Langmuir probe array and energy scrape off layer widths have been measured with and without helical perturbations during ICRF operation. Basic pump limiter data are presented including ion temperatures and C^{+4} impurity profiles. Energy confinement times are reported in ohmically and NBI heated discharges. 5 refs., 7 figs.

7090 (IAE—4457/6) Autoresonance effect while plasma electron-cyclotron heating. Nejshtadt, A.I.; Timofeev, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704948/JAW.

The use of vibrating gyros in ECR plasma heating actualizes the problem of resonance cyclotron interaction in strong H-F field. It is shown that resonance interaction at rather high HF-field amplitude is determined by autoresonance phenomenon. The appearance of high-energy electron rings during ECR plasma heating in open traps an bumpy tores is explained. 13 refs.; 2 figs.

7091 (IAE—4468/6) One-liquid approach in the theory of viscous-resistive ballooning modes in a tokamak. 1. Averaged ballooning equations. Mikhajlovskij, A.B.; Kuvshinov, B.N.; Lakhin, V.P.; Novakovskij, S.V.; Smolyakov, A.I.; Churikov, A.P.; Sharapov, S.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 21p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704950/JAW.

A one-liquid approach in the theory of viscosous-resistive ballooning modes in a tokamak is developed. Qualitative concenpts on the main viscosous effects essential for one-liquid theory of MHD-modes are presented, they are: effect of inertia renormalization and viscosous resistive effect. The procedure of simplifying MHD-equations in the resistive layer with account of viscosity as well as the rest of effects taken into account in the standard theory of MHD-modes is described. Within the framework of approximation of weak ballooning the averaging of ballooning equations in the metrics oscillations is performed. The equations obtained are the generalization of a considerable number of different ballooning mode equations drawn by previous authors. 26 refs.

7092 (IAE—4477/7) Effect of limiter currents on plasma equilibrium and stability in a tokamak. Belashov, V.I.; Gribov, Yu.V.; Putvinskij, S.V.; Brevnov, N.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704951/JAW.

The results of theoretical and experimental research of currents between diaphragms limiting plasma cord in tokamak on plasma equilibrium and stability with an arbitrary form of trans-

verse cross section are presented. It is shown that plasma cord behaviour depends on applied voltage polarity. The phenomena considered can be important for tokamak in which fast plasma compression in a big radius is invisaged. 5 refs.; 3 figs.

7093 **(IAE—4505/7) Anisotropy of ultraviolet radiation of high current discharge in a plasma of exploding wire.** Bogolyubskij, S.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704952/JAW.

The experiments on exploding thin wires in a diode of a high current generator of relativistic electron beams "Triton" have demonstrated that the presence of a hot plasma corona and a colder and denser core is typical for appearing radiation coolled Z-pinch. It is found that for 5-10 ns ultraviolet radiation emmitted by plasma channel has a pronounced axial directivity conditioned by quanta with the energy in the 60-120 eV range. Control experiments have shown that this effect is not connected with various near-electrode phenomena. 6 refs.; 5 figs.

7094 **(IAEA-CN—50/D-4-10) Resistive fluid turbulence and tokamak edge plasma dynamics.** Thayer, D.R.; Diamond, P.H.; Ritz, C.P.; Biglari, H.; Carreras, B.A.; Craddock, G.G.; Hahm, T.S.; Kwon, O.J.; Lee, J.K.; Ohyabu, N. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 17p. (CONF-881015—29). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003154/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Electrostatic and electromagnetic turbulence has been linked to particle and heat transport in tokamaks. Here we report on several related theoretical and experimental investigations of edge plasma dynamics. The theory of thermally-driven convective cell edge turbulence has been developed to treat the coupling of the radiative-condensation instability to the resistivity-gradient expansion free energy. This model of edge turbulence has led to theoretical understanding of several anomalies in electrostatic edge turbulence found from experiment: that fluctuation levels and transport coefficients are larger than naively expected, that potential fluctuations are significantly larger than the density. Impurity gas-puffing experiments on the TEXT tokamak have been performed to test this theory, and have indicated favorable results. Resistive fluid turbulence models have also been explored and applied in the hope of understanding the extensive edge magnetic fluctuation studies. We discuss models of electromagnetic microtearing turbulence, resistive-pressure-gradient-driven turbulence, and ion temperature gradient driven turbulence. In particular we study the role of resistive fluid turbulence with separatrix effects in the L {yield} H mode transition. 36 refs., 2 figs.

7095 (INIS-SU—43, pp 24-26) **Processing of laser plasma interferograms with sharp gradient on the density profile.** Goncharov, S.F.; Serov, R.V.; Yanovskij, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

A method for processing laser plasma interferograms with conjugation of interference bands is proposed. Assuming that the bands are thickened spatial distribution of the density with sharp gradient outside the focal spot is found. 3 refs.; 3 figs.

7096 **(JAERI-M—88-092) ICRF enhancement of fusion reactivity in the presence of alpha particles.** Yamagiwa, Mitsuru; Takizuka, Tomonori. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). May 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755504/JAW.

Absorption of ICRF (ion cyclotron range of frequency) waves by alpha particles and fusion reactivity enhancement due to the ICRF induced ion tail are investigated. The rate of linear absorption by alpha particles increases with the cyclotron harmonic number, and decreases with the ratio of the electron plasma frequency to the electron cyclotron frequency. The deformation of the distribution due to ICRF waves is also examined by using a solution to a Fokker-Planck equation combined with a quasi-linear RF (radiofrequency) diffusion term. It is found that second harmonic ICRF heating is comparatively applicable to the enhancement of the fusion power density even in the presence of alpha particles, while the efficiency of the enhancement is deteriorated markedly by wave deposition to alphas for higher harmonic ICRF heating in the high magnetic field.

7097 **(JAERI-M—88-111) Optimization for getting stable plasma initiation in JT-60.** Yoshino, Ryuji; Neyatani, Yuzuru; Abe, T. and others. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jun 1988. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755509/JAW.

This paper analyses the plasma current build-up just after the breakdown, and investigates the method for obtaining more stable plasma initiation with reduced Volt-second consumption. Control of the amount of particles contained in the wall is necessary for getting the optimum plasma density just after the breakdown, and is essential for obtaining the stable current build-up.

7098 **(JAERI-M—88-137) Design proposal for a JFT-2M TV Thomson scattering system.** Dimock, D.; Yamauchi, Toshihiko. (Princeton Univ., NJ (USA). Plasma Physics Lab.). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755517/JAW.

A design for the optics of a TV Thomson scattering system for JFT-2M is presented, which will measure electron temperature and density profiles having up to 82 points, spanning the horizontal mid plane of the machine. A detailed design for the collecting optics is presented since it is critical to the success of the system. It is shown that the Bouwers type catadioptric collection optics can be color corrected allowing the system to be used over a wide wavelength range. The laser requirements are presented and are easily met with commercially available systems. Two sketches of spectrometer designs are presented for two different sizes of detector. The detector gating and readout requirements are presented and can be met in existing detector systems. The importance of developing larger area detectors is emphasized and a possible detector system is presented.

7099 (JINR—D-2-87-123, pp 143-153) **Low frequency plasma turbulence.** Sudan, R.N. (Cornell Univ., Ithaca, NY (USA)). 1987. NTIS (US Sales Only), PC A18/MF A01. Order Number DE89780033/JAW. (CONF-8608234—).

From Renormalization group-86; Dubna, USSR (26 Aug 1986).

Weakly dispersive low frequency plasma turbulence is shown to be homologous to Navier-Stokes fluid turbulence. Simplified spectral equations are derived for plasma turbulence from the renormalized equations based on Karichan's direct interaction approximation. Applications to electron density irregularities in the equatorial ionosphere and to plasma density gradient-driven drift wave turbulence are discussed. 20 refs.

7100 **(KFTI—87-50) Fast-acting analog-to-digital converter with buffer memory.** Bondarenko, S.P.; Kuznetsov, Yu.K.; Opaleva, G.P.; Taran, V.S. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS. Order Number DE88704969/JAW.

The analog-to-digital converter (ADC) designed for conversion of input voltage into a binary-parallel code with subsequent recording to this code by a buffer memory is described. ADC module has the following characteristics: the range of input voltage is +- 1.02 V; the number of binary discharges, including a sign one, is 9; the convesrion time is 2.5 μs. The capacitance of primary memory is 4x1024 words. The modulus size is 1 M. The modulus is used in the main-line modulator data acquisition and processing system in the "Uragan-3" plasma intallation. 5 refs.; 4 figs.

7101 (LA—11434-MS) Equilibrium and fluctuation analysis for ZTH electrical diagnostics. Miller, G.; Ingraham, J.C. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004311/JAW.

Some of the rationale behind the electrical diagnostics proposed for the Los Alamos Confinement Physics Research Facility, ZTH, is discussed. The axisymmetric equilibrium measurements consist of a poloidal flux array and a toroidally averaged poloidal field array. The equilibrium quantities of interest, for example, the radial magnetic field causing displacement of the outer plasma magnetic surface, are obtained from the measurements by linear combination with constant coefficients. Some possible objectives for the nonaxisymmetric field measurements are discussed. 7 refs., 6 figs.

7102 (ORNL/TM—10792) Alpha-particle losses in compact torsatron reactors. Painter, S.L.; Lyon, J.F. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 44p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004253/JAW.

Loss of alpha particles from compact torsatron reactors with M = 6,9, and 12, where M is the number of field periods, is studied. The direct loss is a relatively get weak function of radius and energy and varies from ~33% for M = 6 to ~18% for M = 12. Loss of alpha particles through scattering into the loss region is calculated using the Fokker-Planck equation and found to contribute an additional alpha-particle energy loss of ~15%. The consequences of these relatively large losses for torsatron reactor design are discussed. A figure of merit that characterizes the orbit confinement for a magnetic configuration is deduced and used to show how the direct alpha-particle losses might be reduced. 22 refs., 15 figs., 3 tabs.

7103 (ORNL/TM—10872) Interior viewing of complex vacuum vessels. Morris, R.N. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004310/JAW.

A ray-tracing and vacuum vessel modeling technique that allows one to generate a view looking into a complex vacuum vessel port is described. The technique is general enough so that details of the contained plasma can be seen as well as the vacuum vessel walls. 5 refs., 10 figs.

7104 (ORNL/TM—10951) Transition from resistive ballooning to neoclassical magnetohydrodynamic pressure-gradient-driven instability. Spong, D.A.; Shaing, K.C.; Carreras, B.A.; Charlton, L.A.; Callen, J.D.; Garcia, L. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004260/JAW.

The linearized neoclassical magnetohydrodynamic equations, including perturbed neoclassical flows and currents, have been solved for parameter regimes where the neoclassical pressure-gradient-driven instability becomes important. This instability is driven by the fluctuating bootstrap current term in Ohm's law. It begins to dominate the conventional resistive ballooning mode in the banana-plateau collisionality regime [μ/sub e//ν/sub e/ {approximately} $\sqrt{\epsilon}/(1 + \nu/\text{sub } *e/) > \epsilon^2$] and is characterized by a larger radial mode width and higher growth rate. The neoclassical instability persists in the absence of the usual magnetic field curvature drive and is not significantly affected by compressibility. Scalings with respect to β, n (toroidal mode number), and μ (neoclassical viscosity) are examined using a large-aspect-ratio, three-dimensional initial-value code that solves linearized equations for the magnetic flux, fluid vorticity, density, and parallel ion flow velocity in axisymmetric toroidal geometry. 13 refs., 10 figs.

7105 (PPPL—2544) Measurements of the ^{3}He fusion product in TFTR. Strachan, J.D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1988. Contract AC02-76CH03073. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004617/JAW.

The 0.8-MeV ^{3}He ion created in the d(d,n)^{3}He fusion reaction is confined in TFTR and can undergo d(^{3}He,p)α fusion reactions. The time evolution, and profile of the 14.7-MeV proton emission indicates that collisional energy transfer with plasma electrons is the dominant process influencing the charged ^{3}He fusion product for TFTR plasmas and that there is no observable anomalous transport. The magnitude of the burnup exceeds classical expectations by a factor-of-two-to-three which is a little beyond experimental uncertainties. 19 refs., 11 figs.

7106 (PPPL—2561) High-resolution bent-crystal spectrometer for the ultra-soft x-ray region. Beiersdorfer, P.; von Goeler, S.; Bitter, M.; Hill, K.W.; Hulse, R.A.; Walling, R.S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1988. Contract AC02-76CH03073. 50p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004622/JAW.

A multichannel vacuum Brag-crystal spectrometer has been developed for high-resolution measurements of the line emission from tokamak plasmas in the wavelength region between 4 and 25 {angstrom}. The spectrometer employs a bent crystal in Johann geometry and a microchannel-plate intensified photodiode array. The instrument is capable of measuring high-resolution spectra ($\lambda/\Delta\lambda \sim$ 3000) with fast time resolution (4 msec per spectrum) and good spatial resolution (3 cm). The spectral bandwidth is $\Delta\lambda/\lambda_0 = 8$ {angstrom}. A simple tilt mechanism allows access to different wavelength intervals. In order to illustrate the utility of the new spectrometer, time- and space-resolved measurements of the n = 3 to n = 2 spectrum of selenium from the Princeton Large Torus tokamak plasmas are presented. The data are used to determine the plasma transport parameters and to infer the radial distribution of fluorinelike, neonlike, and sodiumlike ions of selenium in the plasma. The new ultra-soft x-ray spectrometer has thus enabled us to demonstrate the utility of high-resolution L-shell spectroscopy of neonlike ions as a fusion diagnostic. 43 refs., 23 figs.

7107 (PPPL—2562) Impurity transport in ohmically heated TFTR plasmas. Stratton, B.C.; Fonck, R.J.; Hulse, R.A.; Ramsey, A.T.; Timberlake, J.; Efthimion, P.C.; Fredrickson, E.; Grek, B.; Hill, K.W.; Johnson, D.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1988. Contract AC02-76CH03073. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004623/JAW.

Impurity transport in ohmically heated TFTR plasmas is studied by computer modeling of VUV line emissions from impurities injected using the laser-blowoff technique. The results are sensitive to uncertainties in the ionization and recombination rates used in the modeling; as a result, only a spatially averaged diffusion coefficient and parameterized convective velocity can be measured. Measurements of these transport parameters are presented for deuterium and helium discharges with I/sub p/ = 0.8-2.5 MA, {bar n{sub e}} = 0.6-6.0{times}10^{19} m^{-3}, and Z/sub eff/ = 2-6. Diffusion coefficients are found to be in the 0.5-1.5 m^2/s range, considerably larger than neoclassical values. Nonzero inward convective velocities are necessary to fit the data in most cases. No dependence of the diffusion coefficient on injected element, working gas species, or plasma current is found, but at a given current, the diffusion coefficient is smaller by approximately a factor of two in plasmas near the density limit than in discharges with {bar n{sub e}}<3{times}10^{19} m^{-3}. 31 refs., 9 figs., 3 tabs.

7108 (PPPL—2564) Magnetic fluctuations on TFTR. Boivin, R.L.; Bush, C.; Dylla, F.; Fredrickson, E.; McGuire, K.M.; Morris, A.W.; Schivell, J.; Stratton, B.; Taylor, G.; Timberlake, J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1988. Contract AC02-76CH03073. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004625/JAW.

Data from magnetic pick-up loops (Mirnov coils), located on the wall inside the vacuum vessel of TFTR, are used for studying the edge magnetic fluctuations. Experiments, such as impurity injection, gas puffing, and plasma motion, dramatically affect the fluctuations measured by the coils. A quantitative study of the fluctuation levels during these experiments has been made. Results show that there are simple relations between the amount of impurities or gas injected and changes in the fluctuation levels. Spatial locations of the fluctuation modes have also been tentatively identified. Finally, different models were studied in order to explain the

behavior and dependence of the fluctuations on the relevant parameters of the plasma. 7 refs., 12 figs.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 6005, 6707, 7103

7109 **(CONF-881031—37) Helium-cooled lithiuim compound suspension blanket concept for ITER.** Gohar, Y.; Baker, C.C.; Attaya, H.; Billone, M.; Clemmer, R.C.; Finn, P.A.; Hassanein, A.; Johnson, C.E.; Majumdar, S.; Mattas, R.F. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 6p. NTIS, PC A02/MF A01. Order Number DE89003595/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

This blanket concept uses a dilute suspension of fine solid breeder particles (Li_2O, $LiAlO_2$, or Li_4SiO_4) in a carrier gas (He) as the coolant and the tritium breeding stream. A small fraction of this stream is processed outside the reactor for tritium recovery. The blanket consists of a beryllium multiplier and carbon/steel reflector. A steel clad is used for all materials. A carbon reflector is employed to reduce the beryllium thickness used in the blanket for a specific tritium breeding ratio. The breeder particle size has to exceed few microns ($\geqq$2 microns) to avoid sticking problems on the cold surfaces of the heat exchanger. The helium gas pressure is in the range of 2 to 3 MPa to carry the blanket and the heat exchanger loop. The solid breeder concentration in the helium stream is 1 to 5 volume percent. A high lithium-6 enrichment is used to produce a high tritium breeding ratio and to reduce the breeder concentration in the helium gas. At a lithium-6 enrichment of 90%, the local tritium breeding ratio is 2.03 based on a one-dimensional poloidal model. The total thickness of the helium stream is only 4 cm out of the 50 cm total blanket thickness. The blanket uses a 35 cm of beryllium for neutron multiplication. A simple multi-layer design is employed where the blanket sector has the helium coolant flowing in the poloidal direction. The blanket concept has several unique advantages which are very beneficial for fusion reactors including ITER. 10 refs., 2 tabs.

7110 **(CONF-881031—41) Application of high temperature ceramic superconductors (CSC) to commercial tokamak reactors.** Ehst, D.A.; Kim, S.; Gohar, Y.; Turner, L.; Smith, D.L.; Mattas, R. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003665/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Ceramic superconductors operating near liquid nitrogen temperature may experience higher heating rates without losing stability, compared conventional superconductors. This will permit cable design with less stabilizer, reducing fabrication costs for large fusion magnets. Magnet performance is studied for different operating current densities in the superconductor, and cost benefits to commercial tokamak reactors are estimated. It appears that 10 kA {center←dot} cm{sup {minus}2} (at 77 K and {approximately}10 T) is a target current density which must be achieved in order for the ceramic superconductors to compete with conventional materials. At current densities around 50 kA {center←dot} cm{sup {minus}2} most potential benefits have already been gained, as magnet structural steel begins to dominate the cost at this point. For a steady state reactor reductions of {approximately}7% are forecast for the overall capital cost of the power plant in the best case. An additional {approximately}3% cost saving is possible for pulsed tokamaks. 9 refs., 4 figs., 8 tabs.

7111 **(CU/ERG—1977) An assessment of inertial fusion as a large-scale energy source.** Rogers, J.T.; Robinson, J.E. (Carleton Univ., Ottawa, Ontario (Canada). Energy Research Group; McMaster Univ., Hamilton, Ontario (Canada). Engineering Physics). 1977. 64p. (CE—02083). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A study was conducted on inertial fusion to determine the feasibility and possible implementation dates for large-scale energy production in Ontario. Information in this report comes from a review of the literature and from visits to various offices and laboratories. Principles of inertial fusion are outlined, inertial fusion is examined as a possible energy-producing system and compared to alternative systems, and some of the major engineering requirements for inertial fusion reactors are reviewed. A general conclusion is that inertial fusion will not be available as a commercial energy source before the year 2000. A number of scientific and technological breakthroughs will be required before large-scale energy applications are feasible; if laser fusion is used, current laser efficiency and performance has to be improved by many orders of magnitude. Scientific understanding of the inertial confinement approach to fusion energy lags behind that of the magnetic confinement approach. Demonstration of high density quasi-adiabatic pellet compression, felt to be the proof of the inertial fusion principle, has yet to be achieved. The achievement of pure intertial fusion power production requires pellet gains close to maximum theoretical values, which raises serious questions concerning the engineering feasibility of such schemes without the use of classified pellet designs. Significant research into fusion energy is not recommended for Ontario electric utilities. In view of the general importance of fusion, a coordinated Canadian research program in lasers and materials is suggested. 34 refs., 7 figs., 4 tabs.

7112 **(GA-A—19384) Mirror confinement systems: Final technical report.** (General Atomics Co., San Diego, CA (USA)). Aug 1988. Contract AC03-83SF11713. 88p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004112/JAW.

This report contains: (1) A discussion of azimuthal asymmetrics and fluctuations in RFC-XX-M. Both lead to enhanced radial transport in RFC-XX-M, and presumably most other tandem mirror machines as well; A report on four operating modes of RFC-XX-M which were developed and studied as part of the collaboration. These operating modes were the simple tandem mode, the negative (floating) potential mode, the hot electron mode, and the ECH (electron cyclotron heating) mode; A pulsed rf heated discharge cleaning system which was developed for RFC-XX-M. This method of cleaning proved much more effective than normal glow discharge cleaning, and variations of it are currently in use on the GAMMA-10 tandem mirror and the JIPP TII-U tokamak at the Institute for Plasma Physics at Nagoya; Short descriptions of the diagnostics development and improvement done in conjunction with the work on RFC-XX-M; and a compilation of the work performed at the University of Tsukuba on GAMMA-10. Most of the effort on GAMMA-10 involved diagnostics development and improvement. 16 refs., 42 figs., 1 tab.

7113 (INIS-SU—43, pp 56-58) **Cathode plasma formation in magnetoinsulated high-current diode for hydrogen negative ion production at current density up to 200 A/cm/sup 2/.** Papadichev, V.A.; Shelkovenko, T.A. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780030/JAW.

Kratkie Soobshcheniya po Fizike.; (no.7).

In Experimental and theoretical physics. Collection.

Experiments on plasma formation in high-current diode cathode with magnetic insulation for production of kiloampere currents of negative hydrogen ions are described. Currents of up to 7 kA at current density up to 200 A/cm/sup 2/ are attained. 9 refs.; 3 figs.

7114 (INIS-SU—48, pp 35-41) **Gas transmission, absorption and reemission while metal interaction with hydrogen fast atoms and ions.** Livshits, A.I. 1987. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89780011/JAW.

Voprosy Atomnoj Nauki i Tekhniki.; (no.4).

In Thermonuclear synthesis. Scientific-technical collection.

A phenomenologic description of transmission, absorption and reemission of hydrogen with metals and construction alloys in the case when hydrogen goes to the surface in the form of accelerated atoms and ions is given. Multistage nature of processes of associative thermal separation and the dependence of the rate of these processes on the elementary composition of the surface different at different sides of the membrane (wall, target) and changing due to spraying, reactions with gases of the vacuum system, plasma trans-

fer, surface segregation of additions etc. are taken into account. The possible temperature fall in the membrane thickness is also taken into account. It is shown that during interaction with "hot" hydrogen the determining role in transmission, absorption and reemission of gas is played by the chemical composition of the inlet membrane surface. Estimates for austenite stainless steel are made and it is shown that transmission and accumulation of hydrogen by it can be both less and more by orders of magnitude. 40 refs.; 3 figs.

7115 (INIS-SU—68, pp 396) **Which nuclear reactions are the most perspective ones in the problem of controlled thermonuclear fusion.** Kukulin, V.I. 1988. (In Russian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89780021/JAW. (CONF-8804216—).

From 38. All-Union conference on nuclear spectroscopy and nuclear structure; Baku, USSR (12 Apr 1988).

7116 (ITEF—170(1987)) **Computer code for calculation of two-dimensional problems of gas dynamics with heat conduction in the hydraulic approximation.** Polyakova, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 22p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704578/JAW.

The conditions and the corresponding system of equations to calculate two-dimensional gas dynamics problems in the hydraulic approximation with the time-variable transverse tube cross section are given. The solution algorithm and the technique of counting the above equation system are described. It is supposed to use the program for estimates when preparing experiments with heavy ion beams for the system of heavy ion thermonuclear synthesis. The program is developed for BESM-6 computer in the FORTRAN language. 6 refs.; 7 figs.

7117 (JAERI-M—88-083) **Conceptual design study of Fusion Experimental Reactor (FY87FER). Plant system design.** Saito, Ryusei; Kashihara, Shin-ichiro; Hosobuchi, Hideo and others. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). May 1988. 433p. (In Japanese). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755502/JAW.

This report describes the results of the design coordination and the conceptual design study on plant systems which have been carried out as a part of the design work for the Fusion Experimental Reactor (FY87 FER). The former contains the selection of the reference concept for FY87 FER and giving it flexibility, directions for study and assessment of low physics risk reactors, and the revision of system integration, while the latter mainly describes the design philosophies, construction of systems, and the results of designs and analyses of processes and systems.

7118 (JAERI-M—88-090) **Conceptual design study of Fusion Experimental Reactor (FY87FER). Summary report.** (Japan Atomic Energy Research Inst., Tokyo). May 1988. 506p. (In Japanese). NTIS (US Sales Only), PC A22/MF A01. Order Number DE88755503/JAW.

The design study of Fusion Experimental Reactor(FER) which has been proposed to be the next step fusion device has been conducted by JAERI Reactor System Laboratory since 1982 and by FER design team since 1984. This is the final report of the FER design team program and describes the results obtained in FY1987 (partially in FY1986) activities. The contents of this report consist of the reference design which is based on the guideline in FY1986 by the Subcomitees set up in Nuclear Fusion Council of Atomic Energy Commission of Japan, the Low-Physics-Risk reactor design for achieving physics mission more reliably and the system study of FER design candidates including above two designs.

7119 (JAERI-M—88-097) **Study on electromagnetic-structural behavior of first wall/blanket structure for tokamak fusion reactor.** Minato, Akio. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Jun 1988. 118p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755505/JAW.

The electromagnetic problems related to the structural design of the first wall/blanket structure, which is a major component of Fusion Reactor, have been studied. The electromagnetic load, which is characteristic and very important of Tokamak type, is necessary for the evaluation of the structural integrity at the last item of the design process. A transient electromagnetic phenomena, which include the measurement of the eddy current obtained by the simulated plasma disruption experiment, the vibration behavior of the beam-plate by the dynamic electromagnetic load and the verification of the numerical codes, have been clarified. A static electromagnetic phenomena have been studied to evaluate the applicability of the ferromagnetic material to the first wall/blanket structure of Tokamak Power Reactor. The numerical code, which can calculate the magnetic field of the finite ferromagnetic body, has been developed and the magnetic field distortions inside and outside the materials has been studied. The deformation by the magnetic torque, which generates inside the ferromagnetic material placed in the magnetic field, has been studied. The effects of the magnetic stiffness and the saturated magnetic field to the deformation has been also clarified.

7120 (JAERI-M—88-103) **Accuracy evaluation of the current data and method applied to shielding design of the Fusion Experimental Reactor (FER).** Mori, Seiji; Kobayashi, Takeshi; Seki, Yasushi. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jun 1988. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755506/JAW.

Shielding benchmarking study of the current data and method applied to the Fusion Experimental Reactor (FER) was performed. First, neutron and gamma ray fluxes were calculated by the one-dimensional S/sub N/ code using various cross section libraries and the continuous energy Monte Carlo code. The results were compared in terms of the S/sub N//MC ratio. The worst ratios are about 0.5 and 0.25 for neutron flux and gamma ray flux, respectively. Next, the analytical calculations of the iron sphere transmission experiment of 14 MeV neutrons were performed to examine the accuracy of cross section data of iron, which is the most important material of shield. The E/C ratio is larger than 2 even if the continuous energy Monte Carlo code was used. Thirdly, the influence of geometrical representation of the shield was investigated by comparing the homogeneous model and the heterogeneous model (alternating layers of SS316 and water). As a result, it was made clear that the homogeneous model underestimates neutron flux by a factor of 2. Finally, the necessity of benchmark experiment and improvement of cross section library was pointed out as the further R and D issues.

7121 (JAERI-M—88-109) **Estimation of toroidal field coil stresses from magnetic loads in FER and NET using analytic methods and improved computer subroutine for TFC stress estimation in TRESCODE.** Riemer, B.W.; Miki, Nobuharu; Hashizume, Takashi. (Oak Ridge National Lab., TN (USA)). (Japan Atomic Energy Research Inst., Tokyo). Jun 1988. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755507/JAW.

This report describes the comparison of TF coil stresses in NET and FER. The analyses focus on the straight part of the inner legs, since it is this part of the coil which most directly influences the radial build of the machine. NET's TF coils are wedged together and the centering force on each of the coils is reacted by toroidal compression of the inner legs. The forces that act out of the plane of each coil are reacted by friction between adjacent inner legs such that the set of legs behave much like a cylinder under torsion. In contrast, the FER device employs a bucking cylinder to react the centering load, which incurs a penalty in radial thickness, and the out of plane forces are reacted by the use of shear keys

between adjacent inner legs. Analytic techniques or "hand methods" have been used to estimate and compare the strains and stresses at the inner leg mid-plane section resulting from both in-plane and out-of-plane magnetic forces. Such techniques forced a more thorough understanding of the structural behavior of the coils. The amount of effort in analyzing the NET coil is greater than for FER as the reaction of centering load in its wedged design is more complex, and because it was found that friction plays a very important part in determining the coil stresses. The FER coil is simpler in this regard, and a "hand estimation" of its coil stresses was straightfoward. In this report, the program written to perform these analyses is also described. It was desired to provide new capabilities to the original TF stress subroutine in TRESCODE and to review and improve it where possible. This has been accomplished, and subroutines are now available for use in JAERI's system code, TRESCODE. It is hoped that the inner leg radial thickness can be better optimized by using the program.

7122 **(JAERI-M—88-110) Conceptual design study of Fusion Experimental Reactor (FY87FER). Magnet design.** Miki, Nobuharu; Iida, Fumio; Wachi, Yoshihiro; Toyoda, Katsuyoshi; Hashizume, Takashi; Konno, Masayuki. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jun 1988. 272p. (In Japanese). NTIS (US Sales Only), PC A12/MF A01. Order Number DE88755508/JAW.

This report describes the FER magnet design which was conducted last year (1987). Based on a large uncertainty of the physics assumption, two sets of FER concepts have been developed. One is based on the best existing physics data bases and another is based on rather conservative physics bases. In the magnet design, the improvements of superconducting magnet design were investigated to reduce the reactor size and to realize higher reactor-core performance. In addition, we studied several critical technical issues that affect the magnet design specification.

7123 **(JAERI-M—88-115) Lower hybrid wave heating into neutral beam heated plasma in the JT-60 tokamak.** Ushigusa, Kenkichi; Imai, Tsuyoshi; Ikeda, Yoshitaka and others. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jun 1988. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755511/JAW.

Injection of high-power lower hybrid waves (LHW) of up to 6.0 MW into neutral-beam-20 MW-heated plasmas with the medium electron density regime (n-bar/sub e/ ≦3.5 x 10/sup 19/ m/sup -3/) increases the plasma energy content at the same incremental energy confinement time as in the case of neutral beam heating alone. In addition to thermal electron and ion heating, LHW accelerates beam ions to energies considerably higher than the beam injection energy. In contrast to LH injection into OH plasmas in the same density regime, where substantial high-energy electron production is observed, the case of combined heating shows much less high-energy electrons. The heating efficiency of LHW in the combined heating case tends to decrease as the electron density is increased. Ray-tracing analysis suggests that the accessibility condition prevents effective heating in a high-density plasma. Estimation of wave damping, which is taking account of the beam component of the ion velocity distribution function, indicates that waves are absorbed by beam ions before they are absorbed by electrons.

7124 **(JAERI-M—88-117) In-situ coating device for JT-60.** Obara, Kenjiro; Kawasaki, Kozo; Hiratsuka, Hajime; Kuroda, Takeshi; Ohta, Kazuya; Miyo, Yasuhiko; Ohta, Mitsuru; Ohkubo, Minoru. (Japan Atomic Energy Research Inst., Naka, Ibaraki. Naka Fusion Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 81p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755512/JAW.

JT-60 in-situ coating device which was completed in February 1987 functions as follows; - repair of eroded or damaged surface of first walls such as bumper limiters and liners in JT-60 vacuum vessel by titanium carbide (TiC) deposition; - visual inspection of internal vacuum vessel components; - titanium flashing task for the first wall as surface pumping. The device basically consists of an in-vessel manipulator with four axes, a ohmically heated titanium evaporator, a fiberscope as the observation system, a maintenance stage and an acetylen gas injection system. To meet its functional objectives, the in-vessel manipulator required to be operational in an ultra-high vacuum environment ({similar←to}10/sup -6/ Pa) at high temperatures ({similar←to}300 deg C). The present paper describes the outline of the device and the results of titanium flashing using the JT-60 in-situ coating device.

7125 **(JAERI-M—88-146) Ion-impact desorption.** Oshiyama, Takashi; Nagai, Siro; Ozawa, Kunio. (Kyoto Sangyo Univ. (Japan)). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755523/JAW.

The ion-impact desorption is one of the elementary and important processes in plasma-surface interactions. We have compiled the data on desorption cross sections since 1984. At the same time, we have calculated the desorption cross section from a model based on the elastic collisional processes. Comparisons of the compiled data with the calculated results are presented and then the differences between them are discussed. Processes of ion-impact desorption are also discussed. (author) 155 refs.

7126 **(LA-UR—88-3390) A megajoule class krypton fluoride amplifier for single shot, high gain ICF application.** Rose, E.; Hanson, D.; Krohn, B.; McLeod, J.; Kang, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-881031—35). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002241/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

A design study is underway to define the optimal architecture for a KrF laser system which will deliver 10 MJ of 248-nm light to an ICF target. We present one approach which incorporates final power amplifiers in the megajoule class, achieving 10 MJ with four final amplifiers. Each double-pass laser amplifier employs two-sided electron-beam pumping of the laser gas medium. Details of the design are based on a Monte-Carlo electron-beam deposition code, a one-dimensional, time-dependent kinetics code, and pulsed power circuit modeling. Linear dimensions of the amplifier's extracted gain volume are 6.25 m in height and length and 5.12 m in width. Each amplifier handles 160 angularly multiplexed laser channels. The one-amagat, krypton-rich laser medium is e-beam pumped at 60-kW cm{sup {minus}3} (4-MA @3.3-MV) over the 2-microsecond duration of the laser beam pulse train. 5 refs., 4 figs.

7127 **(NRL-MR—6299) The theory of final focusing of intense light ion beams.** Watrous, J.J.; Ottinger, P.F.; Mosher, D. (Naval Research Lab., Washington, DC (USA)). 26 Oct 1988. Contract AI03-79DP40092. 85p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89003513/JAW.

Efficient transport of the high power light ion beams of interest to inertial confinement fusion experiments may require the use of large radius transport channels. The mismatch in the radii of the transported ion beam and the ICF target requires that the beam be focused following large radius transport. A theoretical description of intense light ion beam focusing with a z-discharge plasma is presented. The theory is based on a Vlasov equation description of a fully charged and current neutralized ion beam, neglecting any angular momentum of the beam ions. An initial ion beams phase space distribution with adjustable parameters is considered so that its effect upon the phase space distribution at the focal plane can be analyzed. A numerical code is used to analyze the effect of angular momentum on the focusing properties of the final focusing cell. The theoretical analysis indicates that the proposed focusing method is viable. The numerical analysis indicates that even if beam ions have a significant amount of angular momentum, the beam can still be focused as indicated by the zero angular momentum theory. 24 refs., 17 figs.

7128 **(NRL-MR—6338) Final focusing of intense ion beams with radially nonuniform current density Z-discharges.** Watrous, J.J.; Ottinger, P.F. (Naval Research Lab., Washington, DC (USA)). 26 Oct 1988. Contract AI03-79DP40092. 39p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003512/JAW.

The spotsize and focal length of a one-eighth betatron wavelength final focusing cell with nonuniform current density distribution are predicted. The predictions are based on a Lie Transform solution to the equations of motion of an ion in an azimuthal magnetic field that models various distributions of the discharge current density. The solution to the nonlinear equations of motion is coupled to a simple phase space concept that yields both the minimum spotsize and focal length of the final focusing cell. The analysis indicates that a final focusing cell with a current density distribution that is strongly concentrated at the channel edge focuses the beam much less efficiently than a channel with a uniform current density distribution. Quantitatively, by employing a simple model azimuthal magnetic field distribution of the form B{sub {theta}}(r) {proportional←to} r{sup N}, the analysis provides an approximate relation between the focused beam radius (r{sub foc}), the unfocused beam radius (r{sub c}), and the ratio of discharge current in the focusing cell (I{sub f}) to that in the transport channel (I{sub c}): r{sub foc} {approximately} r{sub c}(I{sub c}/I{sub f}){sup 1/2N}. 6 refs., 11 figs.

7129 **(ORNL/TM—10428) Consideration of the magnetic field ripple in the design of plasma edge components for Tore Supra.** Klepper, C.C.; Uckan, T.; Mioduszewski, P.K.; McGrath, R.T.; Hertout, P. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004248/JAW.

Design of edge components for a plasma device requires a description of heat and particle flows at the edge of the device. In a tokamak, the ripple of the toroidal field effects the direction of such flows by affecting the direction of the field. In Tore Supra, in particular, the ripple is large (≦8% at the outboard edge). This causes a substantial (≦ factor of 2) increase in heat flux deposited onto the limiter and antenna face. It also reduced the particle removal efficiency of the pump limiters by increasing the distance between the throat opening and the plasma edge. It is therefore important to include the ripple when designing plasma edge components such as pump limiters and rf antennas. A simple, but accurate, scheme for field line tracing is found and used to study this effect. Modeling of the ripple is discussed. 18 refs., 10 figs.

7130 **(PSI—12) Shielding performance of the NET vacuum vessel.** Arkuszewski, J.J.; Jaeger, J.F. (Paul Scherrer Institut, Wuerenlingen (Switzerland)). (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). 12 Aug 1988. 79p. NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS. Order Number DE88704970/JAW.

To corroborate 1-D deterministic shielding calculations on the Next European Torus (NET) vacuum vessel/shield and shielding blanket, 3-D Monte Carlo calculations have been done with the MCNP code. This should provide information on the poloidal and the toroidal variations. Plasma source simulation and the geometrical model are described, as are other assumptions. The calculations are based on the extended plasma power of 714 MW. The results reported here are the heat deposition in various parts of the device, on the one hand, and the neutron and photon currents at the outer boundary of the vacuum vessel, on the other hand. The latter are needed for the detailed design of the super-conducting magnetic coils. A reasonable statistics has been obtained on the outboard side of the torus, though this cannot be said for the inboard side. The inboard is, however, much more toroidally symmetric than the outboard, so that other methods could be applied such as 2-D deterministic calculations, for instance. (author) 4 refs., 44 figs., 42 tabs.

7131 **(UCID—21080-87) Low-density hydrocarbon foams for laser fusion targets: Progress report, 1987.** Haendler, B.L.; Buckley, S.R.; Chen, C.; Cook, A.R.; Cook, R.C.; Hair, L.M.; Kong, F.M.; Kramer, H.D.; Letts, S.A.; Overturf, G.E. III. (Lawrence Livermore National Lab., CA (USA)). Jun 1988. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003728/JAW.

This report describes progress made in the development of direct-drive hydrocarbon foam targets for laser inertial confinement fusion during 1987. The foam materials are polystyrene, resorcinol-formaldehyde, carbonized resorcinol-formaldehyde, and cellulose acetate. The processes for making the foams, their properties, characterization techniques, and the relationship of their properties to target specifications are presented. Progress in the creation and testing of prototype targets is also described.

7132 **(UCRL—98450) Frost as a first wall for the ICF Laboratory Microfusion Facility.** Orth, C.D. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1988. Contract W-7405-ENG-48. 7p. (CONF-881031—44). NTIS, PC A02/MF A01 - OSTI. Order Number DE89004013/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

We introduce the concept of using frost as the first wall of the ICF Laboratory Microfusion Facility being designed to produce 200--1000 MJ of thermonuclear yield. We present one design incorporating 2 cm of frost deposited at 0.1 g/cm^3 on an LN-cooled fiber-reinforced polymer substrate. We calculate that such a frost layer will protect the substrate from ablation by target x rays and debris, and from shock-induced spallation. Postshot washdown with water should permit low-activation operation, and should preserve the original wall properties. We expect the impact of the frost on laser optics to be minimal, and expect the preshot lifetime of thermally unprotected cryogenic targets to be extended by operating the wall at 100-150 K. Moreover, we believe that such a frost first wall will involve little technical risk, and will be inexpensive to construct and operate. 4 refs., 1 fig.

7133 **(UCRL—99625) A carbon-carpet first wall for the Laboratory Microfusion Facility.** Monsler, M.J.; Meier, W.R. (Lawrence Livermore National Lab., CA (USA)). 19 Sep 1988. Contract W-7405-ENG-48. 10p. (CONF-881031—42). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003895/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

A first wall concept for the Laboratory Microfusion Facility (LMF) that uses carbon fibers in a brush- or carpet-like configuration is described. This material and geometric configuration provide an extremely effective way of absorbing the intense burst of soft x-ray radiation from the fusion energy pulse without damaging the underlying structure. The 2-cm-long carbon fibers are pointed at the target so that the x-rays illuminate the sides of the fibers at a glancing angle. We describe how the carpet-like configuration reduces the impulse due to the blow-off of material vaporized by the x-rays. Resulting stresses in the support structure are low enough for the chamber radius to be brought in to 3 m, which is much smaller than a chamber with an unprotected first wall. We conclude that this is a viable and attractive concept for the LMF first wall. 6 refs., 7 figs.

7134 **(UCRL—99756) The international magnetic fusion energy program.** Fowler, T.K. (Lawrence Livermore National Lab., CA (USA)). 6 Oct 1988. Contract W-7405-ENG-48. 21p. (CONF-8808166—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002873/JAW.

From 38. Pugwash conference on science and world affairs; Dagomys, USSR (29 Aug 1988).

In May of 1988, the long tradition of international cooperation in magnetic fusion energy research culminated in the initiation of design work on the International Thermonuclear Experimental Reactor (ITER). If eventually constructed in the 1990s, ITER would be the world's first magnetic fusion reactor. This paper discusses the background events that led to ITER and the present status of the ITER activity. This paper presents a brief summary of

the technical, political, and organizational activities that have led to the creation of the ITER design activity. The ITER activity is now the main focus of international cooperation in magnetic fusion research and one of the largest international cooperative efforts in all of science. 2 refs., 12 figs.

7135 **(WHC-SA—0383) BEATRIX-II: In situ tritium recovery from a fast neutron irradiation of solid breeder materials.** Puigh, R.J.; Hollenberg, G.W.; Kurasawa, T.; Watanabe, H.; Hastings, I.J.; Miller, J.M.; Berk, S.E.; Bauer, R.E.; Baker, D.E. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 7p. (CONF-880929—9). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003915/JAW.

From 15. symposium on fusion technology; Utrecht, Netherlands (19 Sep 1988).

An in situ tritium recovery experiment is being fabricated for the irradiation of Li_2O in the Fast Flux Test Facility located at the Hanford Site, Richland, Washington, United States of America. Two in situ tritium recovery canisters will be irradiated with lithium atom burnups to 4%. One canister will provide fundamental data on tritium release as a function of temperature, gas composition, and flow rate. The other canister will provide integrated performance data from solid pellet specimens with large (450{degree}C) radial temperature gradients. 10 refs., 5 figs., 1 tab.

99 GENERAL AND MISCELLANEOUS

REFER ALSO TO CITATION(S) 6243

7136 **(DOE/ER—0377) Small Business Innovation Research program solicitation: Closing date, February 16, 1989.** (USDOE Office of Energy Research, Washington, DC). [1988]. 85p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004009/JAW.

The Department of Energy (DOE) invites small business firms to submit proposals in this seventh annual solicitation for the Small Business Innovation Research (SBIR) program. Firms with strong research capabilities in science or engineering are encouraged to participate. DOE will support high-quality research or research and development (R and D) on advanced concepts concerning important energy related scientific or engineering problems and opportunities that could lead to significant public benefit if the research is successful. Objectives of this program include stimulating technological innovation in the private sector, strengthening the role of small business in meeting federal research and R and D needs, increasing the commercial application of DOE-supported research results, and improving the return on investment from federally funded research for economic and social benefits to the nation.

7137 **(DOE/ER—0378) Small Business Innovation Research abstracts of Phase 1 awards, 1988.** (USDOE Office of Energy Research, Washington, DC). 1988. 83p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004008/JAW.

Contained in this booklet are abstracts of the Phase 1 awards made in fiscal year 1988 under the Small Business Innovation Research (SBIR) program in the Department of Energy (DOE). This program, now completing its sixth year, was established in compliance with the Small Business Innovation Development Act, Public Law 97-219. As prescribed in the legislation, the program is designed for implementation in a three-phase process, with Phase 1 determining, insofar as possible, the scientific or technical merit and feasibility of ideas proposed for investigation. The period of performance in this initial phase is relatively brief, typically about 6 months, and the awards are limited to $50,000. Phase 2 is the principal research or research and development effort, and the awards are as high as $500,000 for work to be performed in periods of up to 2 years. Phase 3 is the commercial application of the research or research and development effort by small businesses using non-federal funding or, alternatively, it may involve follow-on non-SBIR federal contracts for products or services desired by the government.

7138 **(DOE/MA—0322-3) Listing of awardee names active awards, October 25, 1988.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Procurement and Assistance Management). 1988. 542p. NTIS, PC A23/MF A01 - OSTI. Order Number DE89002429/JAW.

This is a computerized listing issued quarterly from the Procurement and Assistance Data System (PADS), including an alphabetical listing of all acquisition and financial assistance awards with the Department of Energy. (JF)

7139 **(DOE/MA—0335-1) Listing of awardee names retired awards, October 25, 1988.** (Molycorp, Inc., White Plains, NY (USA)). [1988]. 825p. NTIS, PC A99/MF A01 - OSTI. Order Number DE89002430/JAW.

This is a computerized listing issued quarterly from the Procurement and Assistance Data System (PADS), including an alphabetical listing of all acquisition and financial assistance awards with the Department of Energy.

7140 **(LA-UR—88-1000) Los Alamos Science: Number 16.** Cooper, N.G. (ed.). (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 84p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004004/JAW.

It was an unusually stimulating day and a half at Los Alamos when two Nobel Laureates in physiology, a leading paleontologist, and a leading bio-astrophysicist came together to discuss "Unsolved Problems in the Science of Life," the topic of the second in a series of special meetings sponsored by the Fellows of the Laboratory. Just like the first one on "Creativity in Science," this colloquium took us into a broader arena of ideas and viewpoints than is our usual daily fare. To contemplate the evolution and mysteries of intelligent life from the speakers' diverse points of view at one time, in one place was indeed a rare experience.

9901 Management

REFER ALSO TO CITATION(S) 6007, 6008, 6057, 6065, 7187, 7188

7141 **(IAEA-SR—124) Report on the seminar on supporting industrial infrastructure requirements and development for nuclear power, Vienna, 14-18 April, 1986.** (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 13p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704461/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

The Seminar on Supporting Industrial Infrastructure Requirements and Development for Nuclear Power reviewed the following problem areas: establishing the programmatic objectives of a realistic national participation and the technology transfer which would be necessary to qualify such a participation; promoting the level of industrialization which would be necessary to attain the targeted national participation; assuring quality in industry by enforcing comprehensive QA programme; setting-up a national R and D infrastructure to assist the transfer of technology and act as a permanent asset to solve problems as they arise in industry.

7142 **(IAEA-SR—124/1) Concept of a QA-programme for the recipient country, goals and measures.** Thomas, F.W. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 26p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704462/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

Ordering, design and erection of a NPP is a complex business even in a country with experience. Therefore a QA-Programme can be helpful to do the work in a planned and organized manner. In the case of a recipient country the use of administrative QA-measures seems to be a necessary support, especially for the ordering company. It is not the intention of the QA-Programme to

say what to do, and so it cannot solve "political" questions of the business, but the QA-Programme can say how the work has to be done to bring it to a good end. This lecture points out the most important and interesting questions in the phase of establishing a QA-Programme. Examples of solutions are given. (author). 13 figs.

7143 **(IAEA-SR—124/2) Implementation of quality assurance with respect to product quality and scheduling.** Schleimer, W.F. (Kraftwerk Union A.G., Offenbach am Main (Germany, F.R.)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 23p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704463/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

Quality assurance means the whole range of actions which are necessary to meet the client's requirements for the product and the test methods. Audits: The preconditions for fabrication must be fulfilled by approval of the manufacturer's quality assurance system, the staff's qualification, his procedures and his equipments. This is done by means of a system audit at KWU or an equivalent organisation. Specifications: For quality assurance the requirements for the components are fixed in specifications. There are material specifications, process/procedure specifications, components specifications. Approval of Component Design and Manufacture (Scheduling): The approval procedure of a structurally welded part is described as an example of the approval of component design and manufacture, thus representing one small piece of a mechanical equipment. In-Process Surveillance (Product Audit): At KWU the in-process surveillance is regulated by a KQ- or product audit concept. In this concept we have K- and KQ-steps. The list of KQ-steps will be presented. Documentation: All test or examination steps are documented with certificates, lists, and stamps for the final documentation. 19 figs.

7144 **(IAEA-SR—124/3) Requirements for effective technology transfer for engineering and project management. The views of the recipient country and the technology supplier.** Backhaus, K.W. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 19p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704464/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

Technology transfer in the area of engineering and project management for nuclear power plant projects is considered a rather complex and sophisticated matter. Therefore only within a long-term nuclear co-operation a meaningful transfer of such a multifaceted technology can reasonably be achieved. A long-term nuclear co-operation anticipates a nuclear power plant program consisting of a few nuclear power plants of a certain type and size in order to achieve the indispensable effect "learning by doing". The objectives of nuclear technology transfer may be in general or in particular; absorption of a foreign nuclear technology and its adaptation to the conditions and needs of the receiver's country; built-up of industrial infrastructure for planning, construction and operation of nuclear power plants; raising of the general industrial level and achieve a spin-off effect; creation of a basis for independent development of nuclear technology. The technology transfer on one side and the construction program of nuclear power plants on the other side cannot be practiced by two parallel but separated event, however, they form one unit. Contrary to the import of industrial equipment in terms of "black box", by means of a nuclear technology transfer the introduction of new dependencies will be prevented. The technology transfer can remarkably be facilitated by forming a joint venture engineering company in the recipient country. The required know-how potential within a certain time period determines the intensity of the technology transfer and consequently the man power to be involved. The realization of such technology transfer is demonstrated by means of practical examples. (author). 12 figs.

7145 **(IAEA-SR—124/4) Cooperation arrangements related to technology transfer.** Eysel, G. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 17p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704465/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

A developing country which considers to launch a nuclear program should put as much as possible efforts to elaborate a program which suits the country's needs as well as reflects its capabilities. It deems advantageous that a developing country makes use of the experience and knowledge in the nuclear field of a partner country already in the phase when exploring the technical and commercial aspects of a nuclear power program. For the different stages of cooperation between two countries a three-level concept appears advisable for establishing the basis for individual cooperation agreement. The first level are agreements between the governments of both countries on joint scientific research projects and technical development programs covering a broad spectrum of activities not limited to the energy sector. At the second level cooperation agreements can already concentrate on the energy sector and e.g. specifically investigate the energy structure of the developing country. If this investigation results in the decision of the developing country to establish a nuclear power program the next level will cover a broad based cooperation in the nuclear field including a large number of different cooperation contracts in various fields. In this stage of bilateral cooperation the main emphasis will be put on industrial cooperation. Cooperation agreements to be concluded between respective partners of both countries may cover fields related to research and development, engineering of a nuclear power plant, manufacturing of its components, erection and installation as well as operation of the plant. The most common agreements refer to technical cooperation, which covers not only the transfer of blueprints but also training of the recipient's personnel in the partner's country and delegation of experts to the recipient's country. (Abstract Truncated)

7146 **(IAEA-SR—124/5) Participation of the national industry within a nuclear power plant program by technology transfer from the point of view of the main contractor.** Kopp, H. (Kraftwerk Union A.G., Erlangen (Germany, F.R.)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 29p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704466/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

The broad scope of components needed in a nuclear power plant with various technical requirements offer a big opportunity for the participation of local industries in the construction of such plants. Depending on the existing capability of the industrial enterprises, the scope of national participation can be increased by technology transfer on all technical areas to be applied for the construction of NPPs. Such technology requires as basis a nuclear program of the country determined and supported by the government and the utilities. This program has to be defined as realistic as even possible adjoined to the future energy demand of the country. Furthermore the available capability, existing qualifications and equipment of the national industry have to be considered. On the basis of these fundamental requirements a tailormade technology transfer program has to be elaborated in close cooperation with an experienced main contractor of the plant and his partners for such technology transfer and should be established afterwards. This program has to consider not only the goal to achieve finally the independent production of components and equipment for NPPs or the construction of complete power plant units itself, but also the economic benefit of such a program for the country. The costs of technology transfer and the necessary investment of the national industry required for the manufacture of nuclear components have to be thoroughly investigated, based on the expected scope of products to be manufactured for the nuclear power plants according to the nuclear program. Furthermore the application of the technology transferred for other components e.g. for conventional power stations, mineral-

oil or chemical industrial plants has to be considered. (Abstract Truncated)

7147 **(IAEA-SR—124/6) Research and development efforts in the implementation of nuclear power programme in Indonesia.** Suhaemi, T. (National Atomic Energy Agency, Jogyakarta (Indonesia). Research Centre for Nuclear Material and Instrumentations). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 14p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704467/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

Research and development efforts in the implementation of nuclear power programme in Indonesia are presented. According to Indonesia Law, the National Atomic Energy Agency (BATAN) is an official body which is reponsible for all aspects of nuclear development. In implementing the nuclear power, BATAN together with the State Electricity Corporation (PLN) have pioneered the introduction of nuclear power plant in Indonesia by carrying out various activities, studies, seminars, workshops and report writings. A nuclear power planning study was carried out jointly with the International Atomic Energy Agency. The feasibility studies were also carried out by NIRA, an Italian consultant firm in cooperation with BATAN and PLN. To improve research and development, BATAN has established 5 research nuclear centres which function as centres of basic and applied research, isotope and radiation application, standardization and calibration and uranium exploration. Nowadays BATAN is constructing a sophisticated and multidisciplinary complex at Serpong near Jakarta. It is hoped that the participation of the national industry can be synchronized to the construction of the first nuclear power in Indonesia. To endorse the movement towards the industrial and technological future, the National Centre for Research, Science and Technology (known as PUSPITEK) has been established. There will be 12 different laboratories providing facilities for research and development of all aspects of technology. For training manpower, BATAN has established the Education and Training Centre (PUSDIKLAT). BATAN has also collaborated with universities, such as Gadjahmada University in Yogyakarta, in establishing Nuclear Engineering Division in the School of Engineering. 6 refs, 3 figs.

7148 **(IAEA-SR—124/11) Role of R and D in the nuclear infrastructure.** Boulton, J. (Atomic Energy of Canada Ltd., Sheridan Park, Ontario. CANDU Operations). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 10p. (CONF-860419—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704471/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

A solid R and D base is an essential component of the nuclear infrastructure, particularly so when a significant degree of self-sufficiency in the nuclear power program is expected. The R and D base can be formed in a number of ways, as centres of excellence in academic institutions, in industrial or utility associations or in national institutions but, as a minimum, a national nuclear research and development laboratory should be in place. The role played by the R and D organizations is a broad one. Some aspects which will be discussed are: (a) to provide a training ground for the scientists and engineers required in an expanding nuclear program, bridging the gap from the academic world of the universities to the industrialized environment, (b) to provide the expertise necessary, at least initially, to adequately receive and absorb the technology which will have to be transferred during the early stages of development of the nuclear power program; this is particularly important for fuel cycle technology, (c) to provide ongoing support during the construction and operation of the nuclear power plants, (d) to establish credibility and seek acceptance in the world-wide research and development community so that the nation can keep abreast with ongoing technological development.

7149 **(IAEA-SR—124/13) Role of the national R and D organization in the nuclear industrial infrastructure of Korea.** Duck Seung Kim. (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 9p. (CONF-860419—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704473/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

Korea now operates five units of nuclear power plants delivering nearly 30f of her electrical energy and four more units are under construction. Korea gained gradual localization of materials and skills through first generation of power reactors (unit 1,2,3) under complete turn-key contracts and second generation (unit 5 through 10) under component approach contracts. National infrastructure in support of large scale nuclear power program is at forming stages through localization of design and engineering, manufacturing, construction, operation, services and fuel cycle activities. However, Korea is seeking full scope technology transfer along with the next ambitious nuclear project KNU 11 and 12 to be started in 1987. KAERI, the sole national nuclear R and D organization, is now deeply committed in three folds in direct support of Korea's expanding nuclear power program. KAERI is responsible for delivering NSSS system design from KNU 11 and 12, nuclear fuel design from 1989 for all Korea's PWRs as well as CANDU fuels from 1988, and responsible for radwaste management for all the power reactors. (author). 4 figs, 3 tabs.

7150 **(IAEA-SR—124/14) Developing engineering capabilities as a support to a nuclear program.** Rodriguez, A.G. (Empresarios Agrupados, Madrid (Spain)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 22p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704474/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

The performance of a nuclear program needs a quite substantial and diversified volume of technological resources. Its integrated management is one of the basic aspects to be settled. In this regard, the creation of strong engineering organizations with the ability to develop management of the project technical activities as a whole has had success in various countries. These organizations should be provided with suitable means to rapidly assimilate the technology and should serve as a channel and support to local industry in general. The development of a nuclear program also requires the collaboration of other institutions, such as universities and research and development centers. In this sense, engineer and technician training necessities are important both in number and technological qualification, as is the availability of capacities in such different areas as simulation and advanced calculation, geology and soil mechanics, materials, fabrication processes, test laboratories, etc. The volume of technological activities to be developed in relation to a stable, although not necessarily large, nuclear program justifies in itself the assigning of important resources to all the above mentioned activities. However, it should be noted that it has been proved that the nuclear industry is completely pervious as regards other fields of activity. In fact, the more stringent quality requirements are quickly transmitted to other industrial processes, and the engineers trained in this area undergo a far from contemptible turnover towards non-nuclear activities. The basic research area in the nuclear field is not in itself a requirement that has to be in parallel with the development of a nuclear program. However, on medium and long-term bases, it may be interesting for a well balanced commercial program that research activities be established realistically and sensibly, even though short-term practical applications are not necessarily derived from this.

7151 **(IAEA-SR—124/15) National participation in nuclear projects: An effort worth trying.** Albisu, F. (Sener Ingenieria y Sistemas, S.A., Bilbao (Spain)). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 14p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704475/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

National participation in nuclear power projects was a star subject in the seventies in dealings between supplying and receiving countries; around it international gatherings like ICONTT conferences, IAEA meetings, and others were almost institutionalized. The fact that many of those dealings, which were prosecuted for extended periods, are not being materialized into actual projects (suffice it to mention those of Mexico, Pakistan, Turkey, Egypt, China, etc.) has provided a slow shift of the title role in the international nuclear picture to the apparent main obstacles to that materialization, that is, financial and/or non-proliferation aspects. But, in fact, a growing, well planned participation by a country's industry, its organizations and its individuals in its nuclear programme is clearly the most important product (other than, obviously, power itself) that can be derived from such a programme. A product from which many other sectors benefit. This paper deals with significant aspects of the national participation effort, among other: existing industrial infrastructure, and its evaluation; technology transfer channels and its implications; situations where national participation may look less easy to implement: turnkey projects, shop-mounted or barge-installed blocks or complete plants, etc.; progressive participation along the project, and with subsequent projects; the role of the utility and the Government. Cases drawn from the experience of the author's company in several countries, and specially the case of Spain, are commented.

7152 **(IAEA-SR—124/17) Industrial infrastructure for the Indian nuclear power programme.** Srinivasan, M.R. (Department of Atomic Energy, Bombay (India). Nuclear Power Board). (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 14p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704476/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

For the inception of the Indian nuclear power programme, great emphasis has been laid on development of comprehensive indigenous capability in design, construction and operation of nuclear power plants. The choice of the pressurised heavy water reactor as the mainline for India's first generation nuclear power stations fitted into this perspective. Apart from the inherent advantages of high neutron economy, low fuelling costs and high capacity factors, this system offered significant opportunities for manufacture and design of all the components within the country. The development of indigenous capability has not been without its problems, namely cost overruns and delays. The main causes for these delays have been the developmental nature of the jobs involving learning process and continued tightening of the quality control requirements. The strategy of development to be pursued by any country is naturally dependent upon the size of the programme it wishes to embark upon and the state of industrial infrastructure in the country. The Indian experience has demonstrated that for development of a comprehensive capability, it is necessary to have a well formulated reactor policy, a good inter-disciplinary R and D base, a good base of conventional industrial infrastructure, a comprehensive manpower development programme and an innovative management. It is hoped that this experience will be of benefit to other developing countries embarking on their own nuclear programme.

7153 **(IAEA-SR—124/19) Quality assurance as a system of management control in nuclear power plants.** Raisic, N. (International Atomic Energy Agency, Vienna (Austria)). Apr 1986. 15p. (CONF-860419—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704478/JAW.

From Seminar on supporting industrial infrastructure requirements and development for nuclear power; Vienna, Austria (14 Apr 1986).

Quality assurance is considered as a management control system which the owner of a nuclear power plant has to establish for a nuclear power project for ensuring that a plant is built as designed and that defects are corrected. The building up of such a system should start early enough in project activities and before the plant design and construction, in order to ensure correct performance of all activities related to selection of the site for the nuclear power plant, bid specification and evaluation and procurement of services. The QA is a regulatory requirement, but the prudent plant management would create such a system as part of their total project management systems irrespective of formulation of requirement. In fact regulatory requirement should be considered as the criteria to be used by the regulatory organization for evaluation of licensee's QA system and not as an objective to be reached. In this paper the needs for QA system are justified as part of the development of industrial infrastructure for the nuclear power project. Elements of the system are described such as documented QA programme and organizational structures with defined responsibility and functions of individual organizational units, and with control of information flow across the interfaces. The goals and objectives or the project organizations related to achievement and verification of quality are defined as well as system functions in attaining these objectives. This includes the feedback of information to the management on monitoring of performance in project activities, identifying deficiencies and initiating corrective actions. Domestic participation in the nuclear power plant construction will depend on the ability of local construction and manufacturing organizations to achieve high quality standards of products and services that can affect safety and performance of the nuclear power plant. (Abstract Truncated)

7154 **(ORNL/DSRD—13) Life cycle management handbook.** Synder, C.E.; Mott, T.D.; Crutcher, J.W. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 118p. NTIS, PC A06/MF A01 - OSTI. Order Number DE89004315/JAW.

Life cycle management (LCM) is a standard management discipline for acquiring and using information system resources in a cost-effective manner throughout the life of an information system. Three life cycle management strategies are presented in this report. Section 2, which comprises most of the document, describes the full (five-phase) LCM strategy. The condensed LCM strategy and the one-phase LCM strategy are briefly discussed in Sect. 3. Appendix A gives examples of formats for system decision and project management documentation; Appendix B provides a list of defined acronyms; and an expanded contents, intended to serve as an index, appears in Appendix C. 4 refs., 19 figs.

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7155 **(ANL—88-24) Accurate and efficient testing of the exponential and logarithm functions in Ada.** Tang, Ping Tak Peter. (Argonne National Lab., IL (USA)). Nov 1988. Contract W-31109-ENG-38. 93p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89004443/JAW.

We illustrate how table-driven techniques can be used to test highly accurate implementations of EXP and LOG. Our tests report the largest error observed in EXP and LOG accurately to within 1/500 unit in the last place. Methods to verify the tests' reliability are discussed. Results of applying the tests to our own as well as to a number of other implementations of EXP and LOG are presented. 17 refs.

7156 **(CEA-CONF—9577) Percola: a special purpose programmable 64-BIT floating-point processor.** Normand, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1988. 12p. (CONF-8807116—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755600/JAW.

From International conference on supercomputing; Saint-Malo, France (4 Jul 1988).

The computer PERCOLA is designed for lengthy numerical simulations on a percolation problem in Statistical Mechanics of disordered media. The project that the computer is engaged on at present is intended to improve the true values of critical indices characteristic of the behaviour of electrical conductivity at percolation threshold in a system of random resistors. The architecture is based on an efficient highly iterative algorithm to compute the elec-

trical conductivity of random resistor networks. This computer runs programs of percolation problems considered 10 percent faster than the Cray X-MP with the same 64-bit floating-point precision. Operating since May 1987, months of calculation have already been performed. Although best suited to a class of algorithms, the processor includes a powerful 32-bit integer random number generator and has many characteristics of general purpose 64-bit floating-point microprogrammable computers that can run programs for various type of problems with a peak performance of more than 25 Mflops. This high computing speed is not the result of one all-powerful feature, but a balance among several factors including supercomputer derived features such as mainly: concurrent functional units separately controlled from independent microcode fields, distinct buses for data, addresses and instructions, flexible and powerful address generators for matrix processing and an advanced pipeline design implementing high performance VLSI Weitek's and Analog Devices components.

7157 **(CONF-880117—9) Distributed multi-destination routing in hypercube multiprocessors.** Lan, Y.; Ni, L.M.; Esfahanian, A.H. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01. Order Number DE89003641/JAW.

From 3. conference on hypercube concurrent computers and applications; Pasadena, CA, USA (19 Jan 1988).

An efficient interprocessor communication mechanism is essential to the performance of hypercube multiprocessors. All existing hypercube multiprocessors basically support one-to-one interprocessor communication only. However, multi-destination communication (multicast), which is highly demanded in executing many data parallel algorithms, is not directly supported by existing hypercube multiprocessors. A multicast algorithm should attempt to inform each destination in a minimum number of time steps while generating a least amount of traffic. This problem is formally modeled as a graph theoretical problem, the Optimal Multicast Tree problem. We conjecture that the optimal multicast tree problem remains NP-hard even for hypercube topology. A heuristic greedy multicast algorithm which guarantees a minimized message delivery time is proposed. Simulation results show that the performance of the greedy algorithm is very close to optimal solution. Routing of multicast messages is done in a distributed manner. 14 refs. 9 figs.

7158 **(CONF-8709382—1) Floating-point standards: Theory and practice.** Cody, W.J. (Argonne National Lab., IL (USA)). 1987. Contract W-31109-ENG-38. 9p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003598/JAW.

From International workshop on the role of interval methods in scientific computing; Columbus, OH, USA (8 Sep 1987).

ANSI/IEEE Std 754-1985, the IEEE Standard for Binary Floating-Point Arithmetic, has now been joined by IEEE Std 854-1987, A Radix- Independent Standard for Floating-Point Arithmetic. These standards specify floating-point arithmetic systems that are intended to simplify the preparation of high-quality numerical software. The success of these standards hinges on how well they are implemented and how well they are supported by enhancements to algebraic languages. This paper briefly outlines the arithmetic systems specified by the standards, and discusses some existing implementations. 16 refs., 1 tab.

7159 **(DOE/ER/13283—T1) What we learn about process specification languages, from studying recipes.** Demeure, I.M.; Osterweil, L.J. (Colorado Univ., Boulder (USA). Dept. of Computer Science). Aug 1987. Contract FG02-84ER13283. 49p. (CU-CS—373-87). NTIS, PC A04/MF A01 - OSTI. Order Number DE89003909/JAW.

In this paper, we study recipes as examples of process programs. By doing so, we intend to learn about cooking as a process and recipes as specifications written in programming languages. We are looking for some insights into the principles which should be incorporated into computer programming languages, especially languages for the expression of computer software processes. We are also interested in studying how process descriptions are currently effectively communicated between humans in the specific problem domain of cooking recipes. Our work is based upon close study of a modest number of recipes. From this study, we infer the features that a language supporting the expression of recipe programs must have. We suggest that a language that is basically algorithmic can suffice, but only if it also support concurrency, real time constructs, and data type specification that is more complex than what is available in conventional languages. Such a language should probably also support rule-based function evaluation. This language therefore incorporates a mixture of different programming language paradigms (eg. algorithmic, real-time, and rule-based). This suggests that it is necessary to create languages which effectively mix paradigms if we are to cleanly and satisfactorily support the programming of human processes. In that such a language would draw upon innate human capabilities, it would probably also have much wider applicability. 6 refs.

7160 **(DOE/ER/25048—1) A research program in finite element analysis and iterative solution on advanced processors: Progress report, August 1, 1987--October 30, 1988.** Carey, G.F.; Young, D.M. (Texas Univ., Austin (USA). Dept. of Aerospace Engineering and Engineering Mechanics; Texas Univ., Austin (USA). Center for Numerical Analysis). Nov 1988. Contract FG05-87ER25048. 19p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003789/JAW.

This research project concerns finite element methods for partial differential equations and the solution of the discrete systems using iterative methods on advanced vector and parallel processors. This study embraces several aspects of the subject including: theoretical analysis and development of new methods, investigation of associated algorithms, strategies for mapping algorithms to vector and parallel architectures, and finally, applications to large-scale partial differential equation problems such as those encountered in Navier-Stokes theory for viscous flow and in multi-phase multicomponent flows for reservoir simulation.

7161 **(DOE/FTR—9003588) [Europhysics conference on control systems for experimental physics to learn about developments in controls architecture, Villars-Sur-Ollon, Switzerland, September 26--October 5, 1987]: Foreign trip report.** Oerter, B. (Brookhaven National Lab., Upton, NY (USA)). 27 Oct 1987. Contract AC02-76CH00016. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003588/JAW.

The architecture of the next generation of controls system for experimental physics are built around workstations rather than large main frame computers. The choice of network interconnecting the workstations does not appear critical; however, some of the attendees at the conference preferred token ring over CSMA/CD access methods. Devices are becoming more sophisticated, with many containing microprocessors. Communication between devices and nodes on the workstation LAN is via a "field bus". Mil 1553B seems to be the most popular choice for this bus. There was much interest in standardizing interfaces for devices as this is where a great deal of the effort required to build a controls system goes. The European Physical Society has formed a committee to develop interface standards for power converters in an attempt to encourage industry to offer equipment which will ease the interfacing burden.

7162 **(IS—4954) SLADOC: SLATEC documentation program.** Helland, B.; Imani, N. (Ames Lab., IA (USA)). Jul 1987. Contract W-7405-ENG-82. 36p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003746/JAW.

SLADOC is an interactive program which provides on-line documentation for SLATEC routines. SLATEC is a public domain library of over 1000 mathematical routines initiated by a technical exchange committee of the New Mexico Laboratories of Sandia, Los Alamos, and the Air Force Weapons Laboratory. The routines in SLATEC solve problems in linear algebra, solve differential equations and least square problems, perform numerical integration, interpolation and Fourier transforms, find roots of nonlinear equations, and calculate values of elementary and special functions. SLATEC includes routines from LINPACK, EISPACK, DEPAC, FISHPACK, and QUADPACK. SLADOC has been designed to take advantage of the tree organization of the documentation included in the SLATEC package. At each level, there are a number of categories, each of which is partitioned into several subcategories. The leaves of the tree (the lowest level of the hierarchy) are the SLATEC routines with their descriptions. The main page of SLADOC displays part of the SLATEC documentation tree on the

screen. All the nodes (categories) visible on the screen can be selected (with either the mouse or the arrow keys) in order to view their definitions, or to traverse the tree. SLADOC allows the user to search for a routine in three different ways. If the routine name is unknown, the user may either traverse the appropriate branches of the tree until the node "routines" is reached, or use the keyword page to select the appropriate keyword. If a routine name is known, then the command option "search for a routine" can be used to go directly to that node. SLADOC is designed to be user-friendly, so the user should be able to run SLADOC just by using the on-line help facility.

7163 **(JAERI-M—88-132) 2D-SEEP computer code user's manual.** Kimura, Hideo. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Jul 1988. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755516/JAW.

This report describes the 2D-SEEP computer code and presents the direction to use the code effectively. 2D-SEEP code can handle coupled groundwater flow and heat transport, and saturated-unsaturated groundwater flow in a permeable geologic media for the safety evaluation of nuclear waste disposal. This code is written for two-dimensional cartesian or cylindrical coordinate systems. The groundwater flow and heat transport processes are coupled via fluid density and viscosity, and groundwater flow is modelled by single phase flow governed by Darcy's law. The equation of groundwater flow is discretized by using the Galerkin finite element method. The heat conductive and convective equation is discretized by using the Bubnov-Galerkin (up-stream weighting) finite element method.

7164 **(JAERI-M—88-152) Ces-VP: consultation expert system for vector programming of nuclear codes.** Fujisaki, Masahide; Makino, Mitsuhiro; Ishiguro, Misako. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). (Japan Atomic Energy Research Inst., Tokyo). Aug 1988. 141p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755525/JAW.

Ces-VP is a prototype rule-based expert system for consulting the vector programming, based on the knowledge of vectorization of nuclear codes at JAERI during these 10 years. Experts in vectorization can restructure nuclear codes with high performance on vector processors, since they have know-how for choosing the best technique among a lot of techniques that were acquired from the experience of vectorization in the past. Frequency in trial and error will be reduced if a beginner can easily use the know-how of experts. In this report, at first the contents of Ces-VP and its intention are shown. Then, the method for acquiring the know-how of vectorization and the method for making rules from the know-how are described. The outline of Ces-VP implemented on Fujitsu expert tool ESHELL is described. Finally, the availability of Ces-VP is evaluated from the data gathered from practical use and its present problems are discussed.

7165 **(JINR—R-5-88-74) Formal method for analysis of multipattern recognition.** Yatsunenko, Yu.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1988. 14p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704645/JAW.

Submitted to the journal Zh. Vychisl. Mat. Mat. Fiz.

In the search for the global maximum position the integral approach is suggested. Hermit polinom coefficients, which present the row of disintegration of function symmetrized around the point sought for the global maximum are analyzed. Analogy for multidimensional function is considered. The iteration procedure of allocation of the global maxima region and the rule of search termination is proposed for discussion. 9 refs.; 3 figs.

7166 **(JINR—R-10-87-894) Method for decomposition filtration of distributions by nonlinear generalized fitting.** Zlokazov, V.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704652/JAW.

A method for filtering of such fundamental components of distributions as finite or periodic ones is described, which uses the approximation in the quadratic matrices with the weight function, chosen in a special way. The robust fitting is a particular case of such an approximation. 4 refs.; 2 figs.

7167 **(JINR—R-10-87-898) Computer based workstation for development of software for high energy physics experiments.** Ivanchenko, I.M.; Sedykh, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704654/JAW.

Submitted to the journal Programmirovanie.

Methodical principles and results of a successful attempt to create on the base of IBM-PC/AT personal computer of effective means for development of programs for high energy physics experiments are analysed. The obtained results permit to combine the best properties and a positive materialized experience accumulated on the existing time sharing collective systems with a high quality of data representation, reliability and convenience of personal computer applications. 10 refs.; 1 fig.

7168 **(LA—11334-MS) Point-defined geometry for solid modeling.** Jaeger, D.L. (Los Alamos National Lab., NM (USA)). Nov 1988. Contract W-7405-ENG-36. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004546/JAW.

Analysis is an integral part of the design process. Both finite element and boundary element mesh generators require well-defined and well-connected geometry. Well-connected geometry also improves the accuracy of mass property analyses. The basis of future computer aided engineering (CAE) systems will be a solid modeler. We are reporting the results of an effort to write a research-level solid modeler. The modeler is based on concepts that are well suited to analysis work. We believe the modeler is also well suited for the more traditional CAE functions. 5 refs., 6 figs.

7169 **(LA-UR—88-3397) Artificial life.** Langton, C. (Los Alamos National Lab., NM (USA)). 1987. Contract W-7405-ENG-36. 48p. (CONF-8709380—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002240/JAW.

From Artificial life conference; Los Alamos, NM, USA (21 Sep 1987).

Artificial Life is the study of man-made systems that exhibit behaviors characteristic of natural living systems. It complements the traditional biological sciences concerned with the analysis of living organisms by attempting to synthesize life-like behaviors within computers and other artificial media. By extending the empirical foundation upon which biology is based beyond the carbon-chain life that has evolved on earth, Artificial Life can contribute to theoretical biology by locating life-as-we-know-it within the larger picture of life-as-it-could-be. This paper discusses these concepts. 52 refs., 11 figs.

7170 **(LAL—87-56) Neural networks and cellular automata in experimental high energy physics.** Denby, B. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Nov 1987. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756161/JAW.

Within the past few years, two novel computing techniques, cellular automata and neural networks, have shown considerable promise in the solution of problems of a very high degree of complexity, such as turbulent fluid flow, image processing, and pattern recognition. Many of the problems faced in experimental high energy physics are also of this nature. Track reconstruction in wire chambers and cluster finding in cellular calorimeters, for instance, involve pattern recognition and high combinatorial complexity since many combinations of hits or cells must be considered in order to arrive at the final tracks or clusters. Here we examine in what way connective network methods can be applied to some of the problems of experimental high physics. It is found that such problems as track and cluster finding adapt naturally to these approaches. When large scale hardwired connective networks become available, it will be possible to realize solutions to such problems in

a fraction of the time required by traditional methods. For certain types of problems, faster solutions are already possible using model networks implemented on vector or other massively parallel machines. It should also be possible, using existing technology, to build simplified networks that will allow detailed reconstructed event information to be used in fast trigger decisions.

7171 **(ORNL/TM—10799) A neural network algorithm for the multiple traveling salesmen problem.** Wacholder, E.; Han, J.; Mann, R.C. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 32p. (CESAR—88/49). NTIS, PC A03/MF A01 - OSTI. Order Number DE89004150/JAW.

We developed an efficient neural network algorithm for solving the Multiple Traveling Salesman Problem (MTSP). A new transformation of the N-city, M-salesman MTSP to the standard Traveling Salesmen Problem (TSP) is introduced. The transformed problem is represented by an expanded version of Hopfield-Tank's neuromorphic city-position map with (N + M {minus} 1)-city and a single fictitious salesman. The dynamic model associated with the problem is based on the Basic Differential Multiplier Method (BDMM) which evaluates Lagrange multipliers simultaneously with the problem's state variables. The algorithm was successfully tested on many problems with up to 30 cities and five salesmen. In all test cases, the algorithm always converged to valid solutions. The great advantage of this kind of algorithm is that it can provide solutions to complex decision making problems directly by solving a system of ordinary differential equations. No learning steps, logical if statements or adjusting of parameters are required during the computation. The algorithm can therefore be implemented in hardware to solve complex constraint satisfaction problems such as the MTSP at the speed of analog silicon VLSI devices or possibly future optical neural computers. 29 refs., 7 figs.

7172 **(ORNL/TM—10938) Finding eigenvalues and eigenvectors of unsymmetric matrices using a distributed-memory multiprocessor.** Geist, G.A.; Davis, G.J. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004731/JAW.

Distributed-memory parallel algorithms for finding the eigenvalues and eigenvectors of a dense unsymmetric matrix are given. While several parallel algorithms have been developed for symmetric matrices, little work has been done on the unsymmetric case. Our parallel implementation proceeds in three major steps: reduction of the original matrix to Hessenberg form, application of the implicit double-shift QR algorithm to compute the eigenvalues, and back transformations to compute the eigenvectors. Several modifications to our parallel QR algorithm, including ring communication, pipelining and delayed updating are discussed and compared. Results and timings are given. 9 refs., 7 figs., 1 tab.

7173 **(ORNL/TM—10980) A scheme for handling rank deficiency in the solution of sparse linear least squares problems.** Ng, E. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004304/JAW.

Recently we have presented several schemes for computing sparse orthogonal factorizations using static data structures. The novel feature of each scheme is that the data structures are large enough to store both the orthogonal transformations and upper triangular factor explicitly. Thus, multiple least squares problems with the same observation matrix can be solved easily. However, in order to make use of the static data structures, the orthogonal factorization is computed without column interchanges. In this article we develop an algorithm that makes use of the resulting factorization to solve rank-deficient least squares problems. The techniques used are similar to those employed by Bjorck. 11 refs.

7174 **(UCRL—99665) A user interface for computer-based message translation.** Blattner, M.M.; Kou, L.T. (Lawrence Livermore National Lab., CA (USA)). 29 Sep 1988. Contract W-7405-ENG-48. 9p. (CONF-890137—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001714/JAW.

From Hawaii international conference on system sciences-22: languages for parallel processing; Kailua-Kona, HI, USA (3 Jan 1989).

This paper describes a generic message translator that enables a computer user without programming knowledge to specify a program for translating between two different computer-based message systems. Thus messages formatted for use in one system can be automatically translated by the computer into the proper format for use in the other system. The computer user works interactively with the computer to specify the translating program, making use of the appropriate visual paradigms for the message structure. 13 refs., 5 figs.

7175 **(UCRL—99673) PCP: A parallel extension of C that is 99% fat free.** Brooks, E.D. III. (Lawrence Livermore National Lab., CA (USA)). 14 Sep 1988. Contract W-7405-ENG-48. 26p. (CONF-890137—2). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001134/JAW.

From Hawaii international conference on system sciences-22: languages for parallel processing; Kailua-Kona, HI, USA (3 Jan 1989).

The fork-join model for parallel computation requires very efficient compiler and hardware support if it is to be used for tightly coupled applications. Most existing implementations of the fork-join model do not support nested forking, although nested forking could be supported in principle. We present an alternative parallel programming paradigm, the split-join model, which does not require extensive compiler and hardware support for its efficient implementations. Its implementation for C, using the Parallel C Preprocessor, supports fully nested team splitting with an efficiency for tightly coupled applications that fork-join implementations can only hope to asymptotically approach. We describe the language constructs implemented in PCP, their efficient implementation, and some examples of their use in coding tightly coupled applications for shared memory multiprocessors. 8 refs., 1 fig.

7176 **(UCRL—99896) The architecture of future operating systems.** Watson, R.W. (Lawrence Livermore National Lab., CA (USA)). 1 Nov 1988. Contract W-7405-ENG-48. 8p. (CONF-8809187—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89002896/JAW.

From Cray Users Group meeting; Tokyo, Japan (12 Sep 1988).

At the last Cray User Group meeting requirements for future operating systems in the supercomputer environment were outlined. In this paper the basic operating system architectural characteristics that are believed to be needed to meet these requirements are discussed. Then the features of two operating systems are briefly reviewed that have the desired architectural characteristics, NLTSS developed at Lawrence Livermore National Laboratory for Cray computers and MACH developed at Carnegie Mellon University for systems with hardware memory management support. Also listed are some of the reasons why it is believed Unix, at least in its current form, is not the solution to the problem of meeting all the future requirements. 6 refs., 7 figs.

7177 **(WAPD-T—2926) Computer Aided Software Engineering workstation evaluation.** Kotcher, D.A.; Parish, R.B.; Sisson, A.M.; Wenzel, W.A.; Wiancko, B.E. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). 14 Sep 1988. Contract AC11-76PN00014. 23p. (CONF-8811119—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003248/JAW.

From Westinghouse engineering computer applications symposium; Pittsburgh, PA, USA (14 Nov 1988).

This report presents an evaluation of interconnected high performance workstations. The evaluation specifically addresses the benefits to personnel engaged in Computer Aided Software Engineering (CASE) for the design and development of computer software aided by computer workstations. To narrow the scope of the CASE evaluation to a reasonable size, the class of workstations considered was limited to units having the following minimum capabilities: speed to issue 2 to 3 million instructions per second (Mips), 4 megabytes (MB) of central memory, 140 MB of local disk storage, a monitor with 1024 by 960 graphics resolution, and Ethernet compatibility. In addition, software requirements included a vir-

tual memory implementation of the UNIX operating system, the defacto standard networking Transmission Control Protocol and Internet Protocol (TCP/IP), and the network file system (NFS). Support of selected third-party software, such as the TEMPLATE graphics software, and robust tools for software development were also required. These criteria are justified by the use of workstations for maintenance and support of large mainframe based FORTRAN computer programs. The evaluation concluded that workstations are excellent tools for CASE. 1 ref., 1 fig., 6 tabs.

7178 **(ZfI-Mitt—135) Development of information technologies in nuclear research taking into account the conditions of the scientific and technological revolution.** Friedrich, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Oct 1987. 344p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE88704676/JAW.

The development of information processing in nuclear research is discussed starting with the early stages of electronic data processing up to the present. The information technologies applied over that period are considered to be a part of the research technology. From the analysis of developments and current trends conclusions for science strategy and organization are drawn concerning the further application of advanced information technologies. 232 refs., 23 figs., and 25 tabs.

7179 **Fast, accurate algorithm for numerical simulation of exponentially correlated colored noise.** Fox, R.F.; Gatland, I.R.; Roy, R.; Vemuri, G. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). *Physical Review [Section] A: General Physics;* **38**: No. 11, 5938-5940(1 Dec 1988).

The normal procedure for numerical simulation of exponentially correlated colored noise is superseded by the novel algorithm presented here. A differential algorithm is replaced by an integral algorithm which is faster, more accurate, and permits the use of longer step sizes.

7180 **Analysis of multigrid algorithms for nonsymmetric and indefinite elliptic problems.** Bramble, J.H.; Pasciak, J.E.; Xu, J. (4 Physikalisches Institut, Universitaet Stuttgart, Pfaffenwaldring 57, D 7000 Stuttgart 80, West Germany). *Mathematics of Computation;* **51**: No. 184, 389-414(Oct 1988).

We prove some new estimates for the convergence of multigrid algorithms applied to nonsymmetric and indefinite elliptic boundary value problems. We provide results for the so-called 'symmetric' multigrid schemes. We show that for the variable V-script-cycle and the W-script-cycle schemes, multigrid algorithms with any amount of smoothing on the finest grid converge at a rate that is independent of the number of levels or unknowns, provided that the initial grid is sufficiently fine. We show that the V-script-cycle algorithm also converges (under appropriate assumptions on the coarsest grid) but at a rate which may deteriorate as the number of levels increases. This deterioration for the V-script-cycle may occur even in the case of full elliptic regularity. Finally, the results of numerical experiments are given which illustrate the convergence behavior suggested by the theory.

7181 **Construction of preconditioners for elliptic problems by substructuring, III.** Bramble, J.H.; Pasciak, J.E.; Schatz, A.H. (4 Physikalisches Institut, Universitaet Stuttgart, Pfaffenwaldring 57, D 7000 Stuttgart 80, West Germany). *Mathematics of Computation;* **51**: No. 184, 415-430(Oct 1988).

In earlier parts of this series of papers, we constructed preconditioners for the discrete systems of equations arising from the numerical approximation of elliptic boundary value problems. The resulting algorithms are well suited for implementation on computers with parallel architecture. In this paper, we will develop a technique which utilizes these earlier methods to derive even more efficient preconditioners. The iterative algorithms using these new preconditioners converge to the solution of the discrete equations with a rate that is independent of the number of unknowns. These preconditioners involve an incomplete Chebyshev iteration for boundary interface conditions which results in a negligible increase in the amount of computational work. Theoretical estimates and the results of numerical experiments are given which demonstrate the effectiveness of the methods.

7182 **Fast algorithm for linear complex Chebyshev approximations.** Tak, P.; Tang, P. (4 Physikalisches Institut, Universitaet Stuttgart, Pfaffenwaldring 57, D 7000 Stuttgart 80, West Germany). *Mathematics of Computation;* **51**: No. 184, 721-739(Oct 1988).

We propose a new algorithm for finding best minimax polynomial approximations in the complex plane. The algorithm is the first satisfactory generalization of the well-known Remez algorithm for real approximations. Among all available algorithms, ours is the only quadratically convergent one. Numerical examples are presented to illustrate rapid convergence.

7183 **On the complexity of sparse QR and LU factorization of finite-element matrices.** George, A.; Ng, E. (Oak Ridge National Lab., Oak Ridge, TN (US)). *SIAM Journal on Scientific and Statistical Computing;* **9**: No. 5, 849-861(Sep 1988).

Let A be an n x n sparse nonsingular matrix derived from a two-dimensional finite-element mesh. If the matrix is symmetric and positive definite, and a nested dissection ordering is used, then the Cholesky factorization of A can be computed using O(n/sup 3/2/) arithmetic operations, and the number of nonzeros in the Cholesky factor is O(n log n). In this article the authors show that the same complexity bounds can be attained when A is nonsymmetric and indefinite, and either Gaussian elimination with partial pivoting or orthogonal factorization is applied. Numerical experiments for a sequence of irregular mesh problems are provided.

7184 **Error localization for erroneous data: Continuous data, linear constraints.** Garfinkel, R.S.; Kunnathur, A.S.; Liepins, G.E. (Oak Ridge National Lab., Oak Ridge, TN (US)). *SIAM Journal on Scientific and Statistical Computing;* **9**: No. 5, 922-931(Sep 1988).

Data gathered in surveys, questionnaires, and censuses often contain a significant proportion of errors. If each record that fails a set of constraints (edits) is to be corrected, a reasonable model is to find the smallest (cheapest) set of fields which can be changed to yield a passing record. The problem is solved for continuous data and linear constraints using both a cutting plane algorithm based on the set-covering approach and a heuristic based on the simplex method. Extensive computational results are given.

9903 Information Handling

REFER ALSO TO CITATION(S) 6019, 6080, 6256, 6706

7185 **(IFVE-ONF—88-24) Is it easy to link two the SM-4 computer together?.** Klubakov, Yu.M.; Kozelov, A.V.; Lebedev, A.A.; Medved', S.A. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1988. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS. Order Number DE88704958/JAW.

The two-computer complex including "Elektronika 100-25" and "Elektronika-79" computer is described. Hardware of the complex comprises byte parallel interfaces forming a part of the computer set. Software of the complex operating in the medium of TSX monitor permits to collectivize disks of both computers and it is quite clear for users when conducting any operations with disks excluding OS loading. 6 refs.

7186 **(MLM—3521, pp 13-15) Engineering standards accessed with on-line system.** Black, H.A.; Johnson, J.J.; Morgan, D.L. Jul 1988. NTIS, PC A03/MF A01 - OSTI. Order Number DE88013959/JAW. Contract AC04-76DP00053.

In Technology Update - 88.

The Engineering On-line Standards System has been developed to provide Mound engineers with a tool for easily accessing standards information. Whereas Mound standards were formerly

available through manual searching of standards documents, they are now available at the engineer's fingertips. Display of standards information on a PC at the engineer's workstation is accomplished through a menu system that allows several routes of access. Access is usually faster than by the former method, but, more important, access is always to the latest version of the standard. 3 figs.

7187 **(ORNL/TM—10754) Data base design for the Transportation Operational Personal Property Standard System.** Stevens, M.M. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 122p. NTIS, PC A06/MF A01. Order Number DE89004251/JAW.

The Transportation Operational Personal Property Standard System (TOPS) is a large and complex information management system built around a relational data base. Two different methods were applied to the design. The two approaches converged to a fully normalized relational data base, which is described using Entity-Relationship maps and table listings. 10 refs., 5 figs.

7188 **(ORNL/TM—10771) Standards and conventions for TOPS [Transportation Operational Personal Property Standard System] use of PSL/PSA [Problem Statement Language/Problem Statement Analyzer].** Stevens, M.M.; Stevens, S.S.; Singley, P.T. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 64p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89004252/JAW.

The Transportation Operational Personal Property Standard System (TOPS) is an automated integrated information management system developed to help administer the personal property transportation program of the US Department of Defense. Analysis and design information about the system is compiled in a computer data base using the software engineering tool PSL/PSA (Problem Statement Language/Problem Statement Analyzer). This document describes the standards and conventions used in the PSL/PSA representation of the TOPS software system. 4 refs.

9904 Law

REFER ALSO TO CITATION(S) 7145

9905 Civilian Defense

7189 **(LA-UR—88-3753) Avenue of approach generation.** Powell, D.R.; Storm, G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 10p. (CONF-8811115—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003490/JAW.

From U.S. Army symposium on artificial intelligence research for exploitation of the battlefield environment; El Paso, TX, USA (15 Nov 1988).

Los Alamos National Laboratory is conducting research on developing a dynamic planning capability within an Army corps level combat simulation. Central to this research is the development of a computer based ability to "understand" terrain and how it is used in military planning. Such a capability demands data structures that adequately represent terrain features used in the planning process. These features primarily relate to attributes of mobility and visibility. Mobility concepts are abstracted to networks of mobility corridors. Notions of visibility are, for the purposes of planning, incorporated into the definition of key terrain. Prior work at Los Alamos has produced algorithms to generate mobility corridors from digitized terrain data. Mobility corridors, by definition, are the building blocks for avenues of approach, and the latter are the context in which key terrain is defined. The purpose of this paper is to describe recent work in constructing avenues of approach, characterization of avenues using summary characteristics, and their role in military planning. 7 refs., 4 figs., 1 tab.

7190 **(LA-UR—88-3754) Representations to support terrain reasoning.** Powell, D.R.; Wright, J.C.; Slentz, G.E.; Knudsen, P.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8811115—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003489/JAW.

From U.S. Army symposium on artificial intelligence research for exploitation of the battlefield environment; El Paso, TX, USA (15 Nov 1988).

Los Alamos National Laboratory has been cooperating with the Training and Doctrine Command of the US Army to develop a Corps level combat simulation for quick turn around studies. The simulation of ground combat requires representation of combat units, unit activities, command and control, and terrain. This simulation model emphasizes command and control with particular attention to the potential for automating operational planning. As terrain analysis is an essential part of Army operational planning, this has direct influence on the representation of terrain. The availability of digitized terrain makes it feasible to apply computer based techniques to emulate the terrain analysis process for use in the planning cycle. This paper describes processes used to calculate relevant terrain features for use in a simulation model. 13 refs., 6 figs., 6 tabs.

7191 **(ORNL/TM—10973) Two-dimensional combat modeling with partial differential equations.** Rusu, P. (Oak Ridge National Lab., TN (USA)). Dec 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004303/JAW.

The system of partial differential equations to model combat in one spatial dimension has been extended to include two spatial dimensions and has been numerically integrated to demonstrate its capability to describe maneuver. The analysis of a turning maneuver is demonstrated. 6 refs., 1 fig.

7192 **(ORNL/TM—11000) Mathematical descriptions of offensive combat maneuvers.** Santoro, R.T.; Rusu, P.; Barnes, J.M. (Oak Ridge National Lab., TN (USA)). Jan 1989. Contract AC05-84OR21400. 21p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004730/JAW.

Mathematical descriptions of several forms of offensive maneuvers have been calculated using a recently developed two-dimensional nonlinear partial differential equation (PDE) model for describing conflict between opposing forces. Engagement scenarios wherein the attacking force(s) employs the frontal attack, turning movement, envelopment, or infiltration against a fixed defensive force are presented for various combinations of troop and firepower ratios. The time and spatial distributions of the forces are displayed in graphical form along with approximate attrition rates as a function of battle duration. The results establish that the PDE formalism replicates these maneuver forms within the constraints and present development of the model. 7 refs., 8 figs.